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TR-3-185

TRANSMISSION REPORT
VIBROSEIS CW ACOUSTIC SOURCE
CHURCH ANCHOR EXERCISE
AUGUST & SEPTEMBER 1973

Prepared for
LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP)
OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA

Prepared by
B-K DYNAMICS, INC.
15825 SHADY GROVE ROAD
ROCKVILLE, MARYLAND 20850

CONTRACT NO. N00014-74-C-0080

C. P. BRANCART
UNIT INVESTIGATOR

Classified by: ONR CODE 10200S
Subject to GDS, E.O. 11652
Downgrade at 2 Yr Intervals
Declassify on: 31 DEC 1979

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ACKNOWLEDGMENT

The assistance of the following people during the at-sea Vibroseis operation and data reduction is greatly acknowledged: Messrs Sam Lindsey, Curt McKinley and members of Party 38 from Delta Exploration Inc., the master, mate, and crew of the M/V MEDITERRANEAN SEAL, Mr. George Pickens of the Naval Undersea Center, San Diego and Mr. Jack Cawley of Arthur D. Little, Cambridge, Massachusetts.

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PREFACE

The CHURCH ANCHOR Exercise is one of a series of quasi-synoptic ocean environmental acoustic measurement efforts sponsored since 1968 by the Long Range Acoustic Propagation Project (LRAPP). *leg*

leg The area of investigation encompassed 20°N to 50°N and 135°W to 155°W and the Exercise was conducted during August and September, 1973. The Exercise involved a total of 11 surface ships and platforms from which acoustic sources, receivers, and environmental measurement systems were deployed and/or towed.

The Vibroseis system, towed by the M/V MED SEAL was one of three acoustic sources employed. The Vibroseis source is a hydroacoustic device that is towable at speeds up to 5 knots and 91 meter depths. The source has a frequency range of 5 to 225 Hz, and a source level range up to 200 dB/ μPa . The complete transmission log of the Vibroseis source is presented in this report.

Mr. C. Brancart of B-K Dynamics, Inc. served as Unit Investigator aboard the M/V MED SEAL during the Exercise. *leg*

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I. SUMMARY

1. (U) OVERVIEW

The primary mission of the M/V MED SEAL as part of the CHURCH ANCHOR Exercise was the deployment of two hydro-acoustic sources (Vibroseis) at various depths, frequencies and power levels. The originally prescribed track and schedule were modified during the course of the cruise due to very poor weather and resultant limiting of source deployments. The track made good is presented in Figures 1 and 2; ship's position at significant times is given in Appendix A.

The two MED SEAL Vibroseis acoustic sources are categorized as "shallow", 18 m (60 ft) nominal towing depth, and "deep", 91 m (300 ft). (Two shallow transducers were actually used alternately.) During the Exercise, the shallow source transmitted for 223.5 hours representing 85% of the scheduled transmission time. The deep source transmitted for 195.25 hours representing 51% of the scheduled time.

2. (U) VIBROSEIS SYSTEM DESCRIPTION

The Vibroseis system is a seismic energy source that has been applied to soil tests, geophysical explorations, and seismic communications. The system was first developed by the Continental Oil Company, then upgraded by numerous other firms, and is presently being used by Delta Exploration Company of Houston, Texas for their on-shore and off-shore seismic work. The LRAPP office contracted Delta in June of 1972 to produce an 18 m (60 ft) sound source to be used in a Mediterranean operation in August of 1972. This required doubling the depth capability of the presently available 9 m (30 ft) seismic source. At the same time, Delta was requested to design and fabricate a deep 91 m (300 ft) source. The system was air shipped to Bermuda, and after installation on the vessel, system calibration tests were conducted. In October of 1972, long range coherence experiments were conducted in Bermuda waters. During December, the CHURCH GABBRO Exercise was conducted in the Caribbean. In summary, the shallow source was operational as required, the deep system was air transportable, but the latter unit experienced equipment problems that would require further development.

In the spring of 1973 following a competitive procurement which was awarded to Delta Exploration, vibroseis system calibration and acceptance tests were conducted off San Diego. Upon completion of these

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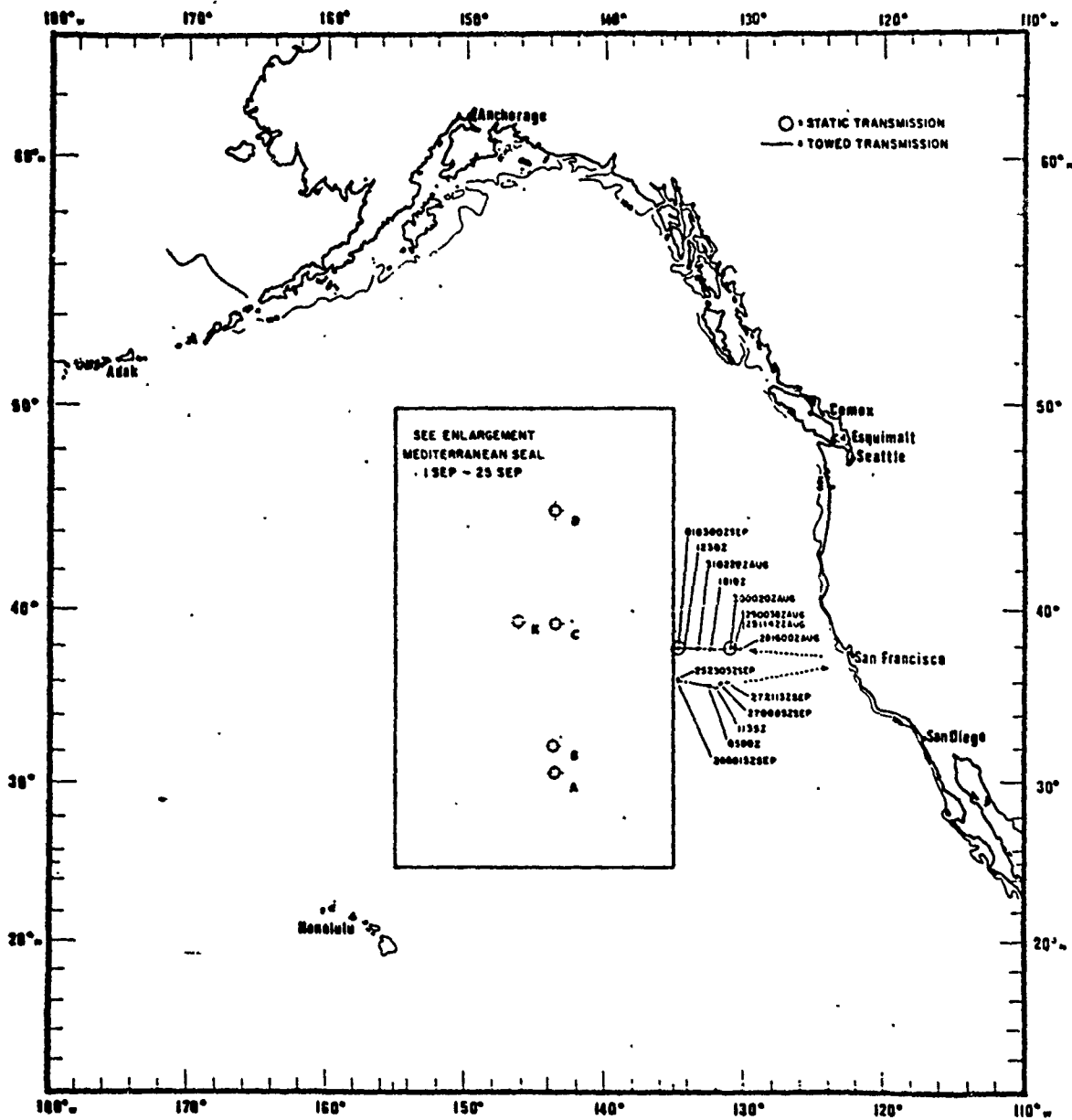


FIGURE 1

M/V MED SEAL 28 AUG - 1 SEP AND 25 SEP - 27 SEP

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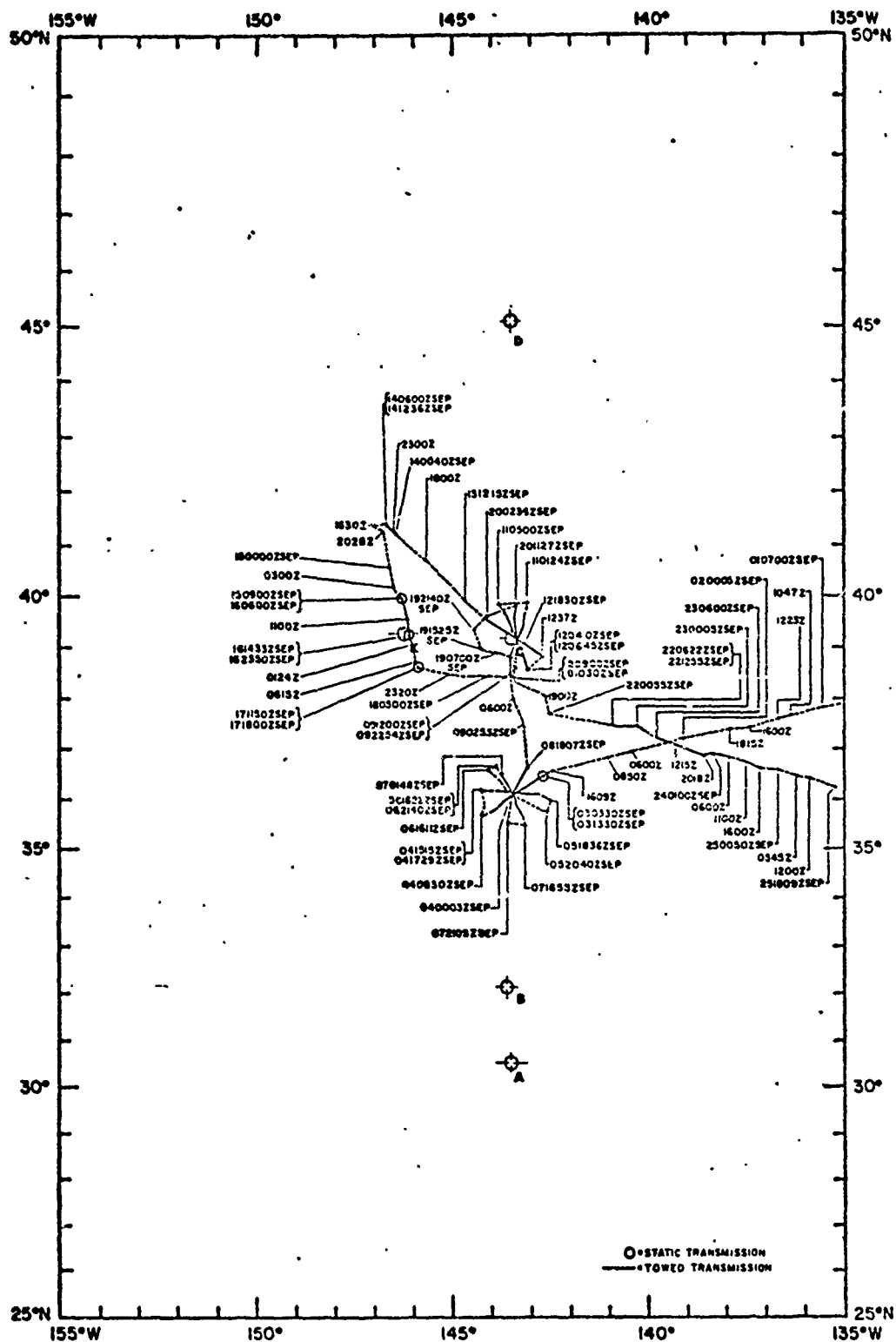
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FIGURE 2

M/V MED SEAL 1 SEP - 25 SEP

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tests, the vibroseis system was used as the hydroacoustic CW source for the CHURCH ANCHOR Exercise.

The Vibroseis hydro-acoustic system consists of two transducers, hydraulic power supplies, servo electronics and an air control system. The transducers (MARK IV) consist of two 122 cm (48 inch) diameter hemispheres connected by a hydraulic ram capable of mechanical expansion and contraction of the surfaces relative to each other to produce a desired acoustic pressure wave. It is thus a rough approximation of the classical "pulsating sphere" sound source. The transducers were capable of operating at various depths to a maximum of 146 m (480 ft).

The transducer is controlled by a four stage electro-hydraulic servo system. The electronic system consists of modular units which contain circuits to process and control the feedback loops from the transducer. The basic input to the electronic system is the desired wave form; the system is then servoed to follow this wave form. The hydraulic supply consists of self-contained diesel engines driving variable displacement pumps capable of maintaining constant pressure with variable flows.

The primary frequency range of the Vibroseis system is 10 Hz to 100 Hz, but it may also be operated from 100 Hz to 250 Hz at reduced power output levels. Maximum source level over the primary frequency range is 190 to 207 dB/ μ Pa. Distortion of the acoustic signals is approximately 10% at 30 Hz with a phase stability on the order of $\pm 1^\circ$ at 40 Hz and 63 Hz.

Figure 3 illustrates the towing configuration. The towing mechanism consists of the leading line, pipe and hose assembly and the retrieval line. The required hydraulic, electrical and air circuits are routed through the pipe and hose assembly, which in turn is connected to the leading line in such a manner that the whole assembly represents a faired structure. The towing forces for the transducer are taken by a wire rope assembly; the retrieving line is used to raise and lower the projector.

3. (U) SOURCE LEVEL MONITORING SYSTEM

The Vibroseis source power levels (two shallow sources used alternately, one deep) were monitored by receiving hydrophones mounted 3.7 m (12 ft) from the geometric center of each source. The hydrophones were calibrated USRD Type F36 transducers obtained from the Naval Research Laboratory Underwater Sound Reference Division in Orlando, Florida. A spectrum analyzer with CRT display monitored the

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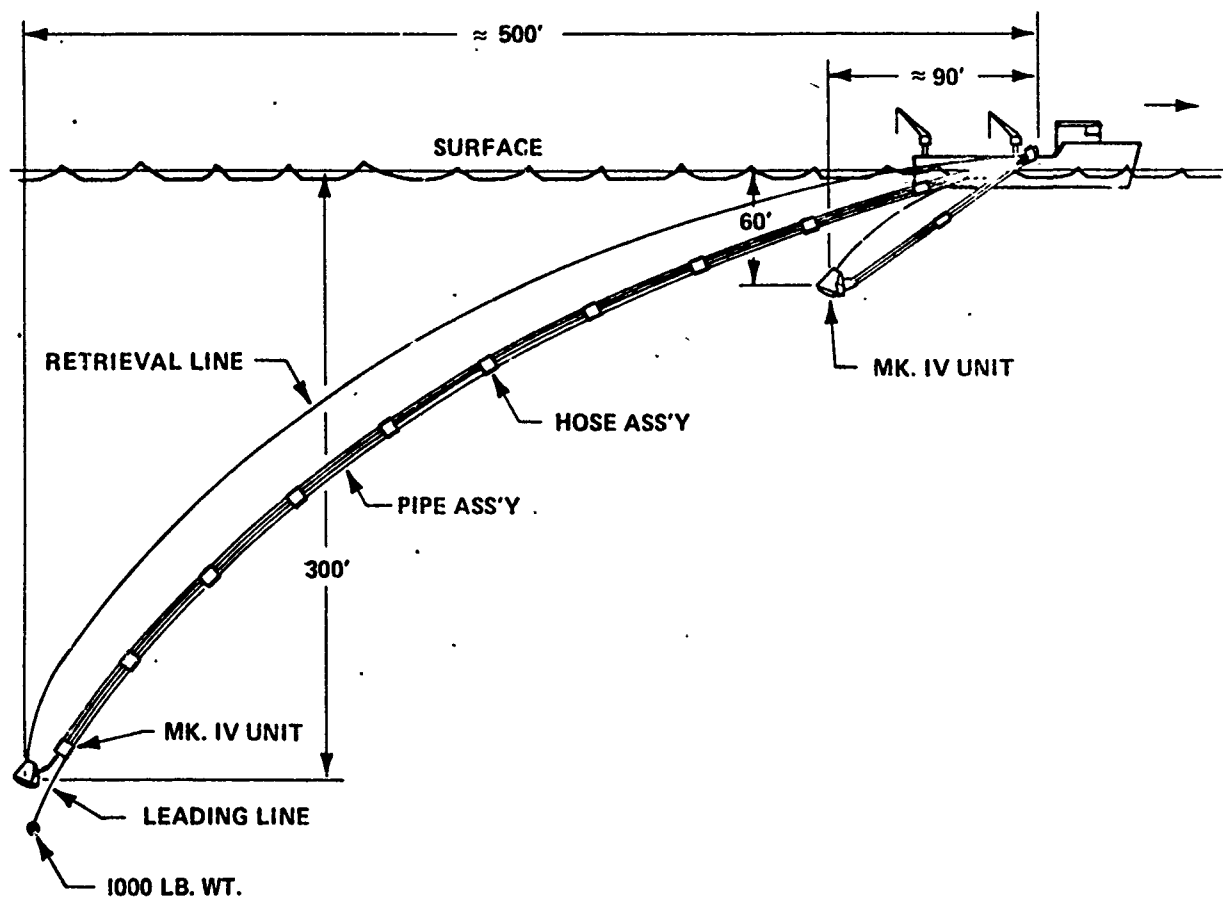


FIGURE 3
VIBROSEIS TOWING CONFIGURATION

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signal output as measured by these hydrophones on a continuous basis and was used to tune the fundamental signal output as to both frequency and power level. A Visicorder was also employed to provide periodic (approximately every 15 minutes) hard copy records of the signal. Following Exercise operations these records were used to compute actual power levels of the sources by correcting for instrumentation conversion factor, hydrophone sensitivity, and low frequency roll off. These computations and corrections are discussed in Section II, Data Reduction.

4. (U) SOURCE DEPLOYMENT

A summary of Vibroseis source transmissions is presented in Table 1. The transmission periods are shown together with frequency and sound power level of the fundamental frequency, source depth, and transmission cycle schedule. The sound power levels shown in the table are arithmetic means of the measured power levels during the transmission period with variance of the power level indicated where appropriate.

The detailed Vibroseis source transmission log, which includes every data point and plots of source power level and depth vs time for all transmissions is presented in Section III, VIBROSEIS SOURCE TRANSMISSION LOG.

5. (U) EQUIPMENT PERFORMANCE

During the major portion of the transmission periods, it was possible to maintain source power level within ± 1 dB of the average value of power level being transmitted. Generally, power level variations became greater and the number of extraneous frequencies in the spectral output increased just before system failure. Towing depth of the source was generally maintained within ± 10 m of the prescribed depth for the deep source and ± 2 m for the shallow source.

System performance generally deteriorated with time following start of transmission. As presently configured, a gross estimate of the time between failures is 20 hours. Once the system has failed, approximately 12 hours repair time is required. In periods of sea state greater than 2, turn around time is increased due to the wet and hazardous condition of the fantail where the source is repaired. Sea states greater than 4 prevent deployment of the deep source and accelerate system failure. Figure 6 is a graphical representation of the prevailing Beaufort wind scale vs time, indicating the weather during scheduled operating periods was extremely poor. A detailed review of the recorded data indicates the direct relationship between source transmission quality and quantity and weather conditions.

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TABLE 1

SUMMARY OF VIBROSEIS SOURCE TRANSMISSIONS

EVENT # MS	TRANSMISSION TIME GMT		FREQ Hz	SPL dB// μ Pa	DEPTH Meters	TRANSMISSION CYCLE SCHEDULE	NOTES (See Pg. A-14)
	Start	Stop					
002	290300	290755	11	177, 178 183, 187 192	19	0X00 to 0X10	(1)
			23	171, - 188, 194 192	19	0X15 to 0X25	
			38	169, 169 176, 180 188	19	0X30 to 0X40	
			100	164, 168 176, 180 186	19	0X45 to 0X55	
002	312045	010040	11	- , 183 181, 185	110	0X45 to 0X55	(1)
			23	184, - 194, 190	110	0X00 to 0X10	& (2)
			38	181, 184 189, 192	110	0X15 to 0X25	
			100	177, 182 187, 188	110	0X30 to 0X40	
003	292000	292308	38	-	18	-	(3)
	300215	311738	38	181 \pm 1	18	0X00 to 0X08 0X15 to 0X23 0X30 to 0X38 0X45 to 0X53	
005B	030000	031000	38	176 \pm	20	Continuous	
007	031400	040800	100	192 \pm 1	19	0X00 to 0X55	
	031400	040800	38	196 \pm 0 1	98	0X00 to 0X55	
009	041900	051400	100	192 \pm 1	19	0X00 to 0X55	
	041900	051400	38	196 \pm 1	103	0X00 to 0X55	
013	062000	071600	29	190 \pm 2	19	0X00 to 0X55	
	062000	071600	38	195 \pm 1	112	0X00 to 0X55	(4)

*The nomenclature used to represent the transmission cycle schedule is as follows:
 0X00 to 0X10 indicates transmission occurred the first 10 minutes of the hour;
 the X indicates the cycle was repeated every hour. For example, the first transmission, the 11 Hz signal was transmitted from 290300 to 290310, 290400 to 290410.....
 290700 to 290710.

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TABLE 1 (Continued)

SUMMARY OF VIBROSEIS SOURCE TRANSMISSIONS

EVENT # MS	TRANSMISSION TIME GMT		FREQ Hz	SPL dB// μ Pa	DEPTH Meters	TRANSMISSION CYCLE SCHEDULE	NOTES (See Pg. A-14)
	Start	Stop					
017	080200	082000	38	192 + 1	19	0X00 to 0X55	
	080200	081000	29	195 + $\frac{1}{0}$	103	0X00 to 0X55	
	081000	082000	29	194 + 1	103	0X00 to 0X55	
021	092200	101723	29	181 + 1	20	0X00 to 0X08 0X15 to 0X23 0X30 to 0X38 0X45 to 0X53	(5)
025	092200	100902	11	187 + 2	105	0X00 to 0X08	
			23	182 + 3	105	0X15 to 0X23	
			38	182 + 2	105	0X30 to 0X38	
			100	182 + 1	105	0X45 to 0X53	
	110900	120423	29	178 + 2	20	0X20 to 0X08 0X15 to 0X23 0X30 to 0X38 0X45 to 0X53	
			11	189	110	0X00 to 0X08	
			23	184	110	0X15 to 0X23	
			38	183	110	0X30 to 0X38	
			100	182	110	0X45 to 0X53	
027	121200	130753	29	179 + 1	19	0X00 to 0X08 0X15 to 0X23 0X30 to 0X38 0X45 to 0X53	
			11	186 + 3	105	0X00 to 0X08	
			23	185 + 2	105	0X15 to 0X23	
			38	182 + 2	105	0X30 to 0X38	
	121345	130308	100	182 + 2	105	0X45 to 0X53	
			38	193	19	0000 to 0008	(6)
			197	197	37	0015 to 0023	
			196	196	56	0045 to 0053	
031 Depth Cycle Down	151000	151538	196	196	72	0100 to 0108	
			197	197	94	0130 to 0138	
			198	198	110	0145 to 0153	
			198	198	128	0215 to 0223	
			197	197	136	0300 to 0338	
						Repeat above Cycle	

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TABLE 1 (Continued)

SUMMARY OF VIBROSEIS SOURCE TRANSMISSIONS

EVENT # MS	TRANSMISSION TIME GMT		FREQ Hz	SPL dB// μ Pa	DEPTH Meters	TRANSMISSION CYCLE SCHEDULE	NOTES (See Pg. A-14)
	Start	Stop					
Depth Cycle Up	171600	171651	38	194 194	133 128	{ 0000 to 0008 0015 to 0023 0045 to 0051	(7)
Power Cycle	151700	152153	11	180, 184 189, 194 197	19	0X00 to 0X08	(U)
			23	177, 181 184, 190 195	19	0X15 to 0X23	
			38	175, 178 182, 188 193	19	0X30 to 0X38	
			100	177, 177 182, 187 192	19	0X45 to 0X53	
	151700	152153	100	183, 185 189, 197 200	131	0X00 to 0X08	
			38	184, 186 190, 195 199	131	0X15 to 0X23	
			23	182, 184 190, 195 197	131	0X30 to 0X38	
			11	173, 187 186, 185 -	131	0X45 to 0X53	
036	160530	161545	23	193 \pm 1	18	{ 0X00 to 0X05 0X15 to 0X20 0X30 to 0X35	
			38	193 \pm 1	18	{ 0X05 to 0X10 0X20 to 0X25 0X35 to 0X40	
			100	193 \pm 1	18	{ 0X10 to 0X15 0X25 to 0X30 0X40 to 0X45	

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TABLE 1 (Continued)

SUMMARY OF VIBROSEIS SOURCE TRANSMISSIONS

EVENT # MS	TRANSMISSION TIME GMT		FREQ Hz	SPL dB// μ Pa	DEPTH Meters	TRANSMISSION CYCLE SCHEDULE	NOTES (See Pg. A-14)
	Start	Stop					
037	161600	162115	100	192 + 1	18	1600 to 1645	
			38	193 + 1	18	1645 to 1815	
			100	192 + 1	18	1815 to 1900	
			38	192 + 1	18	1900 to 2030	
			100	191 + 1	18	2030 to 2115	
038	162300	170945	23	194 + 1	19	0X00 to 0X05 0X15 to 0X20 0X30 to 0X35	
			38	193 + 1	19	0X05 to 0X10 0X20 to 0X25 0X35 to 0X40	
			100	190 + 1	19	0X10 to 0X15 0X25 to 0X30 0X40 to 0X45	
	162300	170945	11	185 + 1	105	0(X-1)00 to 0(X-1)45 (5 cycles only)	
			100	198 + 1	105	0X00 to 0X05 0X15 to 0X20 0X30 to 0X35	
			23	200 + 1	105	0X05 to 0X10 0X20 to 0X25 0X35 to 0X40	
			38	200 + 1	105	0X10 to 0X15 0X25 to 0X30 0X40 to 0X45	
039	171000	171515	100	191 + 1	19	1000 to 1053	
			38	192 + 1	19	1053 to 1215	
			100	191 + 1	19	1215 to 1300	
			38	193 + 1	19	1300 to 1430	
			100	191 + 1	19	1430 to 1515	
	171000	171515	29	197 + 1	131	1000 to 1047	(8)
			23	197 + 1	136	1047 to 1130	
			11	180 + 1	136	1130 to 1215	
			11	182 + 1	132	1300 to 1345	
			23	201 + 1	132	1345 to 1430	
			29	195 + 1	130	1430 to 1515	

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SUMMARY OF VIBROSEIS SOURCE TRANSMISSIONS

EVENT # MS	TRANSMISSION TIME GMT		FREQ Hz	SPL dB// μ Pa	DEPTH Meters	TRANSMISSION CYCLE SCHEDULE	NOTES (See Below)
	Start	Stop					
α	201500	210323	29	193 \pm 1	19	0X00 to 0X08 0X15 to 0X23 0X30 to 0X38 0X45 to 0X53	(9)
A	221902	230655	38	196 \pm 1	110	0X00 to 0X55	
	241126	241143	38	195 \pm 1	110	0X00 to 0X55	
	242135	242155	38	196 \pm 1	110	0X00 to 0X55	
	260200	261135	38	192 \pm 1	110	0X00 to 0X55	
	260100	260155	38	192 \pm 1	18	0X00 to 0X55	(10)
A	261135	270547	38	192 \pm 1	100	0X00 to 0X55	
	270600	270849	38	192 \pm 1	22	0X00 to 0X55	

VIBROSEIS SOURCE TRANSMISSION NOTES TO TABLE 1

- (1) Transmissions were made at four frequencies and one power level per hour, for five separate power levels and consequently, five hours of transmission for the shallow source, and for four separate power levels, and consequently four hours of transmission for the deep source.
- (2) The deep source did transmit from 291900 to 291956 at 100 Hz at 165, 170, 176, and 184 dB// μ Pa using the shallow source transmission schedule.
- (3) The variability of the SPL was too great (the difference in SPL was 10 dB); therefore making the value of the data highly questionable.
- (4) The SPL for the deep source was questionable in the time period 070715 to 071135. During this time period, power level dropped down to approximately 191 dB// μ Pa.
- (5) The source broke down three times resulting in erratic SPL values. Unable to evaluate the variability of data due to insufficient data points.
- (6) The source transmitted at eight depths; eight minutes ON, seven minutes OFF and eight minutes ON per depth; then 23 minutes OFF to lower source to next depth. Unable to evaluate the variability of the source output due to insufficient data points.
- (7) This was the depth cycle up, but transmission was terminated because period was an ambient noise period.
- (8) Note that depth was held constant at approximately 132 m, and not at two separate depths as required by the Exercise Plan.
- (9) The deep Vibroseis source did transmit from 201906 to 202038, but the hydrophone was not operational and no SPL data was obtained.
- (10) Shallow source was put into use because deep source was not operational.

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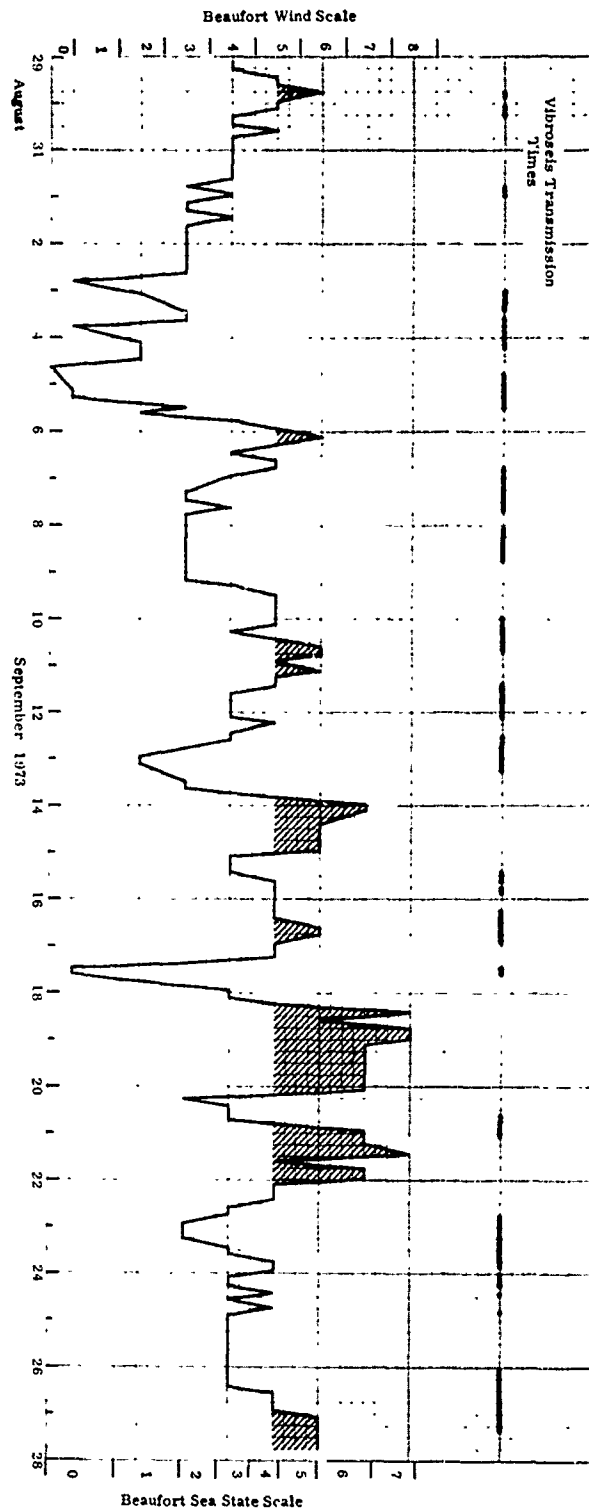


FIGURE 4
VIBROSEIS WEATHER LOG

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A summary of source transmission time and system continue due to weather or equipment failure is presented in Table 2. The shallow source was operational 85% of scheduled periods, 100% accounting for the weather time. This high performance was due in part to the fact that the two identical transducers could be changed in approximately 20 minutes. Turn around time for the single deep source was roughly 12 hours. It was operational 51% of scheduled periods, 58% accounting for the weather time.

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TABLE 2
SUMMARY OF VIBROSEIS SOURCE TRANSMISSION TIME

Event No.	SHALLOW SOURCE TRANSMISSION					DEEP SOURCE TRANSMISSION						
	Exercise (1) Programmed Hours	Corrected (2) Programmed Hours	(3) Actual Hours	(4) Weather Hours	(5) Down Time Hours	Operational Per Event %	Exercise Programmed Hours	Corrected Programmed Hours	Actual Hours	Weather Hours	Down Time Hours	Operational Per Event %
002	5	5	5	0	0	100	4	4	4	0	0	100
003(6)	69 1/2	48 1/2	25	23 1/2	0	51.5	69 1/2	48 1/2	1 3/4	23 1/2	23 1/4	3.6
005B	10	10	10	0	0	100	-	-	-	-	-	-
007	20	18	18	0	0	100	20	18	18	0	0	100
009	20	19	19	0	0	100	20	19	19	0	0	100
013	20	20	20	0	0	100	20	20	15	0	5	75
017	20	18	18	0	0	100	20	18	18	0	0	100
021	20	20	20	0	0	100	20	20	11	0	9	55
025	20	19 1/2	19 1/2	0	0	100	20	19 1/2	3 1/2	0	16	17.9
027	20	20	20	0	0	100	20	20	14 1/2	0	5 1/2	72.5
31(7)	-	-	-	-	-	-	5 3/4	5 3/4	5 3/4	0	0	100
31(8)	5	5	5	0	0	100	5	5	5	0	0	100
36	11 1/4	10 1/4	10 1/4	0	0	100	11 1/4	10 1/4	0	0	10 1/4	0
37	5 1/4	5 1/4	5 1/4	0	0	100	5 1/4	5 1/4	0	0	5 1/4	0
38	11 1/4	10 3/4	10 3/4	0	0	100	11 1/4	10 3/4	10 3/4	0	0	100
39	5 1/4	5 1/4	5 1/4	0	0	100	5 1/4	5 1/4	5 1/4	0	0	100
31(10)	-	-	-	-	-	-	5 3/4	5 3/4	0	0	5 3/4	0
α	28	28	12 1/2	15 1/2	0	44.6	28	28 (12)	1 1/2	15 1/2	11	54
8	0	1(11) (11)	1(11) (11)	0	0	-	77	84 1/2	44	2 1/4	38 1/4	52.1
9	0	3 1/2	2 3/4	0	3/4	-	50	32(12)	18 1/4	0	13 3/4	57
TOTALS		262 1/2	223 1/2	39	0	85.1		379.5	195 1/4	41 1/4	143	51.4

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NOTES TO TABLE 2

VIBROSEIS TRANSMISSION LOG

- (1) Indicates the number of transmission hours that were scheduled. These numbers include the event changes that occurred during the Exercise.
- (2) Indicates the number of transmission hours taking into account changes in speed of advance and changes in the event because of equipment difficulties.
- (3) Indicates actual in-the-water transmission time. Off periods for filter changes, alternating from port to starboard shallow source, etc., were not subtracted from the actual in-the-water times.
- (4) Indicates nonoperating time due to bad weather.
- (5) . Indicates nonoperating time due to equipment problems.
- (6) Event MS 003 was cut short by 21 hours because of the additional time expended to complete event 002.
- (7) Depth cycle down event.
- (8) Power cycle event.
- (9) This could be considered by Delta to be weather time. The deep source was not operational due to equipment problems, and the shallow source was operational.
- (10) Power cycle up. In actuality, one hour of transmission was obtained with the deep source, but transmission was stopped because of a quiet period (ambient noise day). When the event was supposed to occur, the equipment was nonoperational.
- (11) The shallow source was used because the deep source was not operational. These transmission times were not included in the total number of hours for the shallow source.
- (12) Event β was increased by $7\frac{1}{2}$ hours to complete the scheduled distance. Seven and one half hours were consequently subtracted from event θ .

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II. DATA REDUCTION

The Vibroseis source power levels (two shallow sources used alternately, one deep) were monitored by receiving hydrophones mounted 3.7 m (12 ft) from the geometric center of each source. The hydrophones were calibrated USRD Type F36 transducers obtained from the Naval Research Laboratory Underwater Sound Reference Division in Orlando, Florida. A spectrum analyzer with CRT display monitored the signal output as measured by these hydrophones on a continuous basis and was used to tune the fundamental signal output as to both frequency and power level. A Visicorder was also employed to provide periodic (approximately every 15 minutes) hard copy records of the signal. Following Exercise operations, these records were used to compute actual power levels of the sources by correcting for instrumentation conversion factor, hydrophone sensitivity, and low frequency roll off.

1. HYDROPHONE SYSTEM

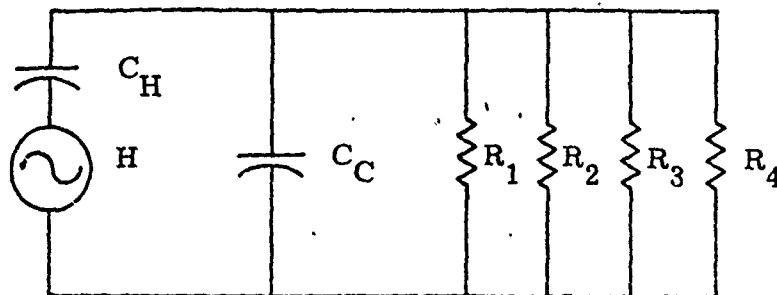
The schematic of the hydrophone system used to monitor the Vibroseis sources' power levels is presented in Figure 5. Operating characteristics of USRD F36 type hydrophones are presented in Appendix B; Details of the individual monitoring hydrophones and attached cables are presented in Table 3.

To compute source levels, the equivalent hydrophone system was first determined. The system capacitance and hydrophone sensitivity were determined according to Thevenin's Theorem. The resultant system schematic is presented in Figure 6 and values of system components are summarized in Table 3.

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HYDROPHONE SYSTEM SCHEMATIC



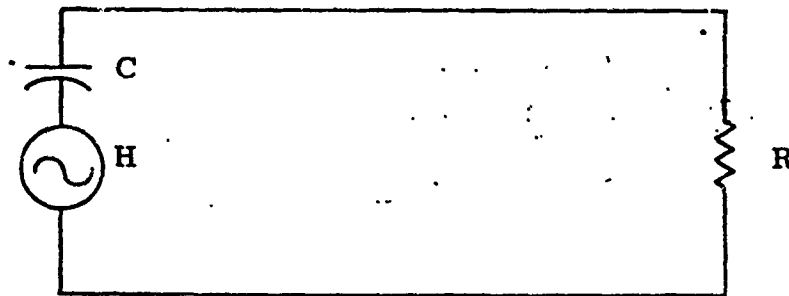
where	H	Hydrophone and cable sensitivity
	C_H	Capacitance of hydrophone and attached cable
	C_C	Capacitance of additional lead-in cable (only required on deep source)
	R_1	Carbon resistor 2.2 meg Ω
	R_2	VTVM - HP Model 403B - 10 meg Ω
	R_3	OSCILLOSCOPE - TEKTRONIC Model 465 1 meg Ω
	R_4	SD330 Spectrum Analyzer - 100 K Ω

FIGURE 5

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EQUIVALENT
HYDROPHONE SYSTEM SCHEMATIC



where H hydrophone and cable equivalent sensitivity
 C system capacitance
 R composite load - 86.5 K Ω

The corrected hydrophone sensitivity is equal to

$$\left[\begin{array}{l} \text{hydrophone and attached} \\ \text{cable sensitivity} \end{array} \right] + 20 \left[\log C_H - \log C \right]$$

and

$$C = C_H + C_C$$

FIGURE 6

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TABLE 3
SUMMARY OF HYDROPHONE SYSTEM CHARACTERISTICS

Hydrophone Designation	Serial #	Sensitivity dB/ μ Pa/v	Cable Length m	Capacitance - pico farads			Equivalent Sensitivity dB/ μ Pa/v
				Hydrophone & Attached Cable C_H	Lead-in Cable C_C	System Capacitance C	
Shallow Starboard	40	- 203.3	61	69,000	—	69,000	- 203.3
Shallow Port	70	- 203.3	61	66,000	—	66,000	- 203.3
Deep	46	- 206.2	152	88,500	9200	97,700	- 207.1

* These values are for one of the two wires of the signal cable tied to the shield. If the wire had been balanced to ground, the capacitance would have been less and the sensitivity would have been greater.

2. SOURCE LEVEL DETERMINATION

The Vibroseis source was continually monitored by a receiving hydrophone. Approximately every fifteen minutes, spectrum recordings were made for assessment of acoustic levels of fundamental frequency and harmonics that were being transmitted by the source. These recordings, which were made on a Visicorder, gave the uncorrected source level of the Vibroseis. This source level data must be corrected for instrumentation conversion factor, hydrophone sensitivity and low frequency roll off. In summary, the corrected Vibroseis source level was obtained as follows:

$$\left[\begin{array}{c} \text{Corrected} \\ \text{source} \\ \text{level} \end{array} \right] = \left[\begin{array}{c} \text{Measured signal} \\ \text{amplitude from} \\ \text{SD330 output} \end{array} \right] \left[\begin{array}{c} \text{Instrument} \\ \text{conversion} \\ \text{factor} \end{array} \right] + \left[\begin{array}{c} \text{Hydrophone} \\ \text{sensitivity} \\ \text{correction} \end{array} \right] + \left[\begin{array}{c} \text{Low fre-} \\ \text{quency roll} \\ \text{off correction} \end{array} \right]$$

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a. Measured Signal Amplitude and Instrument Conversion Factor

The fundamental frequency on each spectrum recording was measured with a linear scale and tabulated as a function of time. These measurements were compared to an auxiliary calibration record that was made to equate source level with measured fundamental frequency amplitude. This record was formed by supplying a constant frequency signal from an HP 3302 B oscillator to an HP 403 B VTVM directly to the SD 330 analyzer and stepping the signal level in 1 dB increments. The oscillator output was set at 0.060 volts rms; this level was recorded to be equivalent to 190 dB// μ Pa. This 190 dB// μ Pa value was based on the hydrophone calibration curve presented in Figure 7. At the conclusion of the Exercise, when the data were being reduced, the correct hydrophone calibration curve and sensitivity values were used. The SD 330 input controls were set on the most sensitive scale (0.1 volt). A graphical representation of this calibration record is presented in Figure 8. The above equation establishes the fact that the SD 330 had a threshold source level of 145.5 dB// μ Pa. This means that only the source signals with a level greater than 145.5 dB// μ Pa were recorded.

The voltage of 0.06 Vrms is equivalent to -24.4 dBv based on a hydrophone sensitivity of 202.4 dB// μ Pa/v. Using the hydrophone sensitivity (the modified hydrophone sensitivity due to capacitive loading for the deep source hydrophone), the pressure field is computed to be equal to the sensitivity less 24.4 dBv. The spreading loss due to the 12 ft distance (between one and four yards) is $20 \log 4$, or 12 dB. This 12 dB is added to the pressure field value to obtain the signal strength at the source. For the deep source, the corrected source level was 194.7 dB in lieu of 190 dB. For the shallow starboard and port sources, the source level was 190.9 dB. With these two corrections, it is now possible to rewrite the equation for the curve in Figure 8 to incorporate the specific hydrophone sensitivities. Therefore, for

Shallow sources (starboard and port)

$$\text{Source level} = 146.4 + 8.7 \quad (x)$$

Deep source

$$\text{Source level} = 150.2 + 8.7 \quad (x)$$

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VIBROSEIS CALIBRATION CURVE

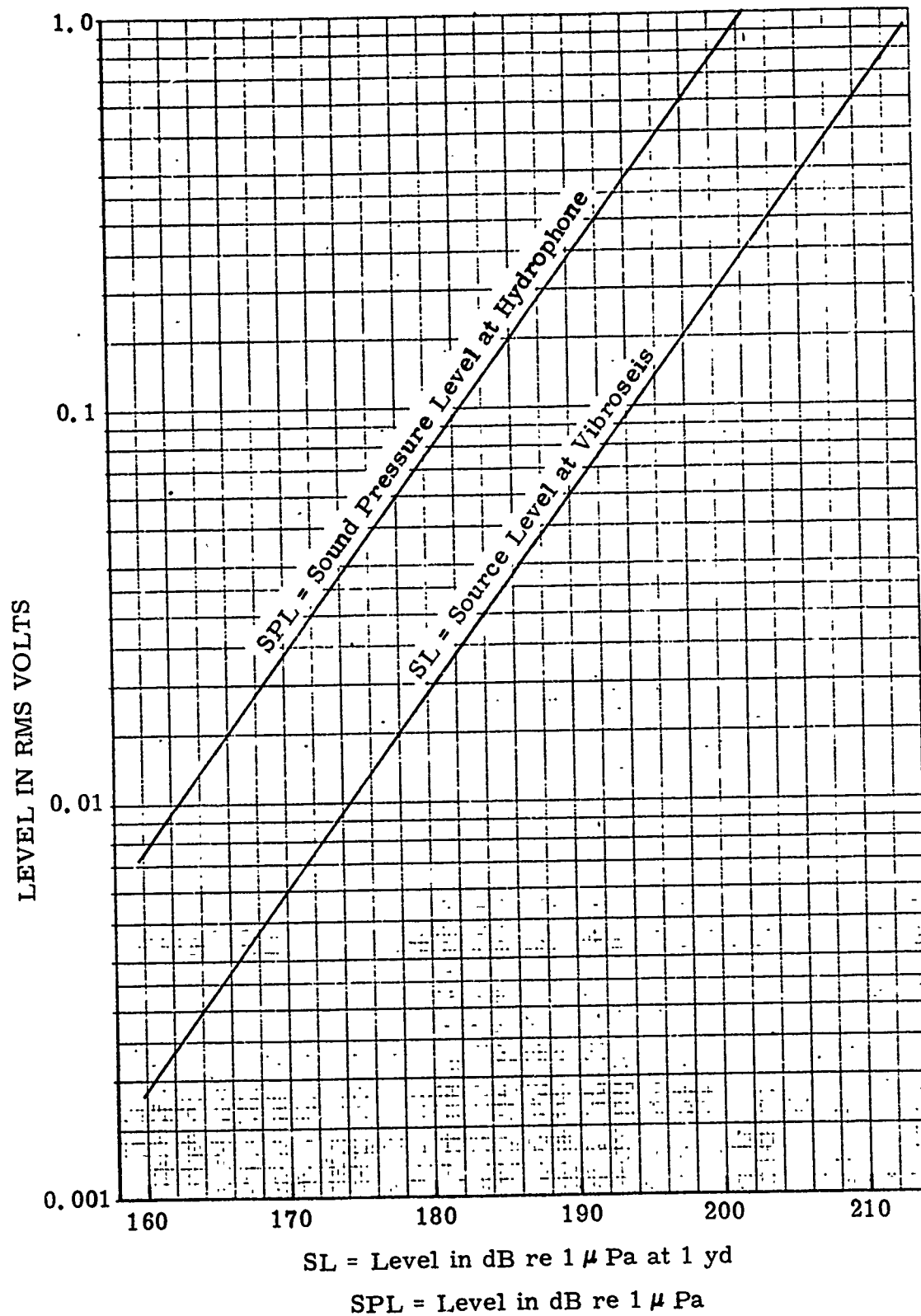


FIGURE 7

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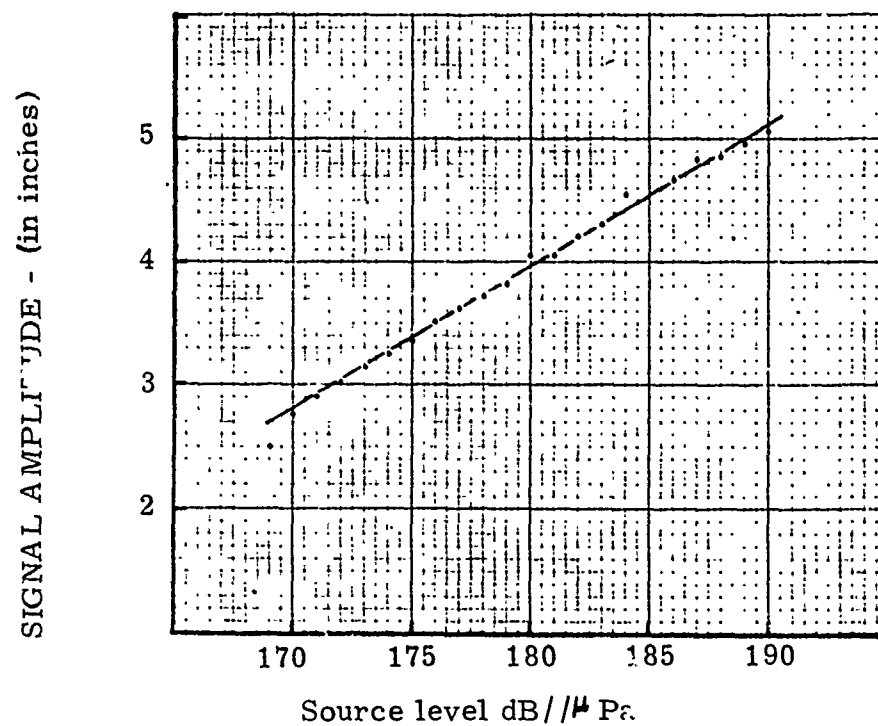


FIGURE 8

The equation for the linear curve presented in Figure 8 is:

$$\begin{array}{l} \text{Source} \\ \text{level} \end{array} = 145.5 + 8.7 (x)$$

where x is the amplitude of recorded
signal measured in inches

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b. Frequency Response Correction

The system capacitance and the shunting resistance, as presented in the equivalent hydrophone system schematic in Figure 6, results in the classical low frequency roll off of the hydrophone system response, the results of which are summarized in Table 4 and Figure 9.

TABLE 4

ROLL OFF CORRECTION FACTOR

Frequency Hz	Shallow Hydrophone		Deep Hydrophone
	Starboard	Port	
10	9.09	9.43	6.58
11	8.37	8.71	5.95
15	6.19	6.49	4.11
23	3.88	3.93	2.23
29	2.66	2.84	1.53
38	1.74	1.87	0.95
50	1.09	1.18	0.58
70	0.59	0.64	0.30
100	0.30	0.33	0.15

The net result of the low frequency roll off was that the low frequency transmissions were of a higher power level than anticipated because the roll off correction was only discovered after the completion of the Exercise. The low frequency roll off problems became quite evident when, as recorded, the second and sometimes third harmonic of the 11 Hz transmission was greater in magnitude than the fundamental signal.

3. CALIBRATION CURVES

When the instrumentation conversion factors, the hydrophone sensitivity correction, and low frequency roll off correction are applied, calibration curves for specific frequencies and hydrophones can be constructed. These curves were prepared for the fundamental frequencies of 11, 23, 29, 38 and 100 Hz, and are presented in Figures 10 through 14.

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ROLL OFF CORRECTION FACTOR

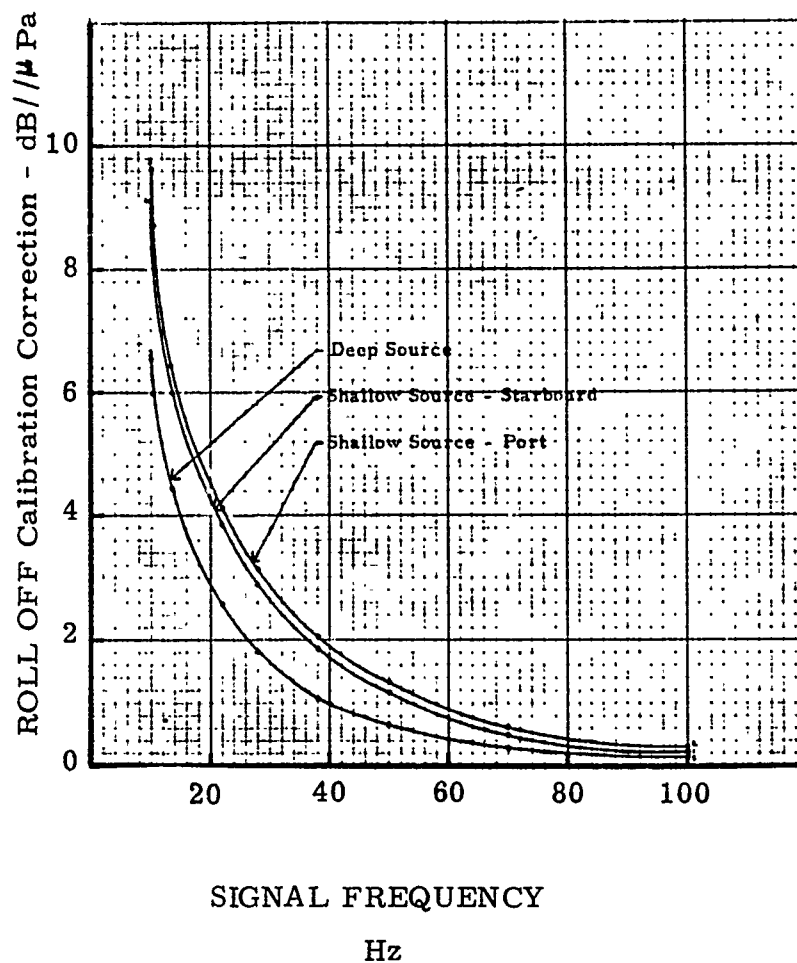
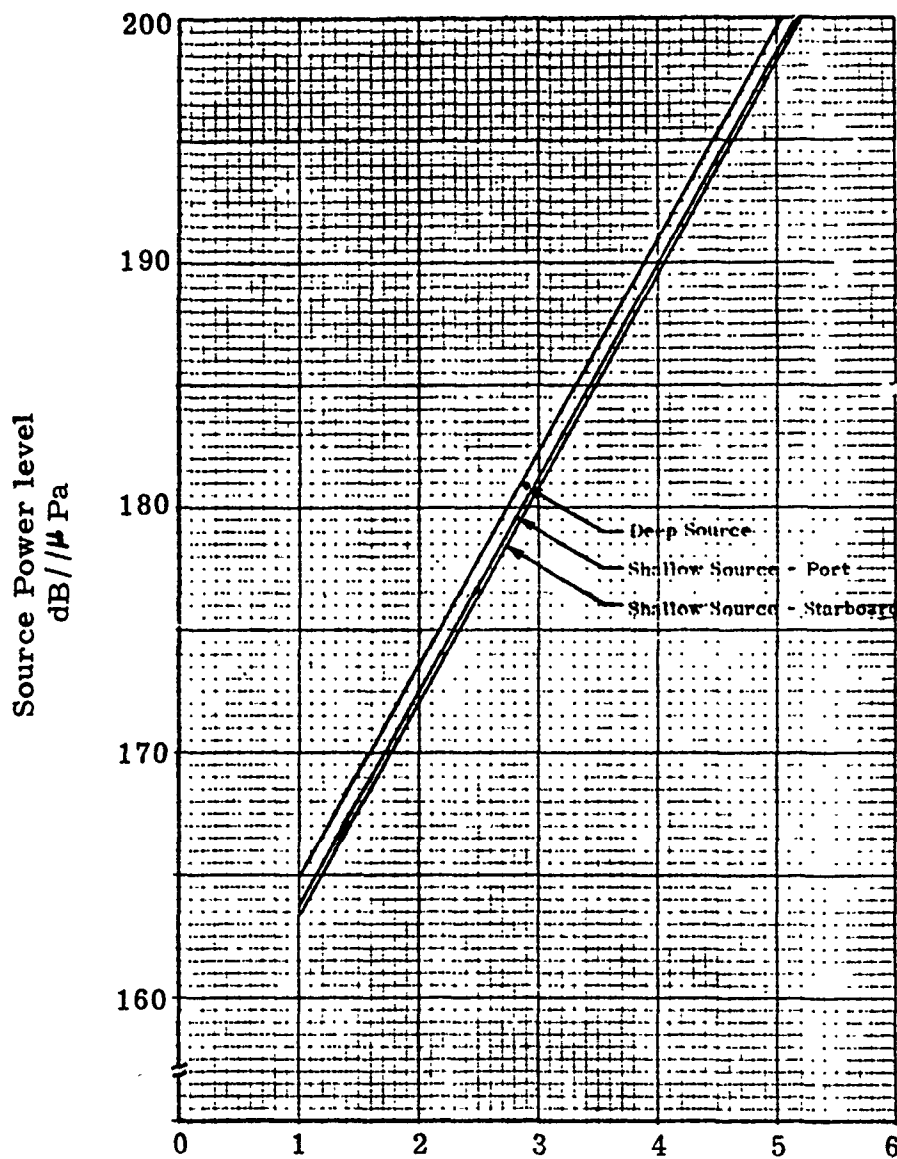


FIGURE 9

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VIBROSEIS SYSTEM
CALIBRATION CURVE
For 11 Hz Transmission



SIGNAL AMPLITUDE FROM
VISICORDER RECORD - INCHES

FIGURE 10

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VIBROSEIS SYSTEM
CALIBRATION CURVE
For 23 Hz Transmission

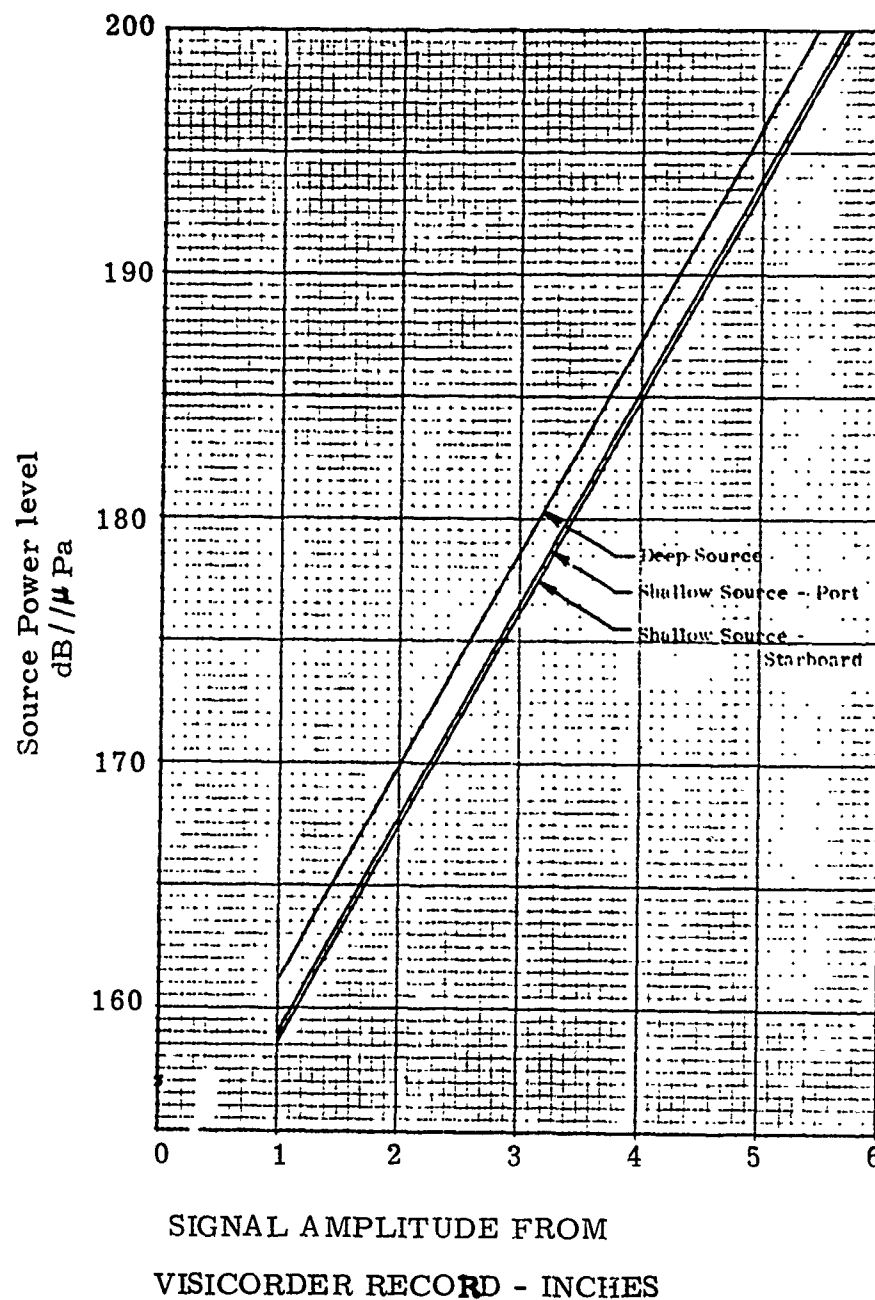


FIGURE 11

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VIBROSEIS SYSTEM
CALIBRATION CURVE
For 29 Hz Transmission

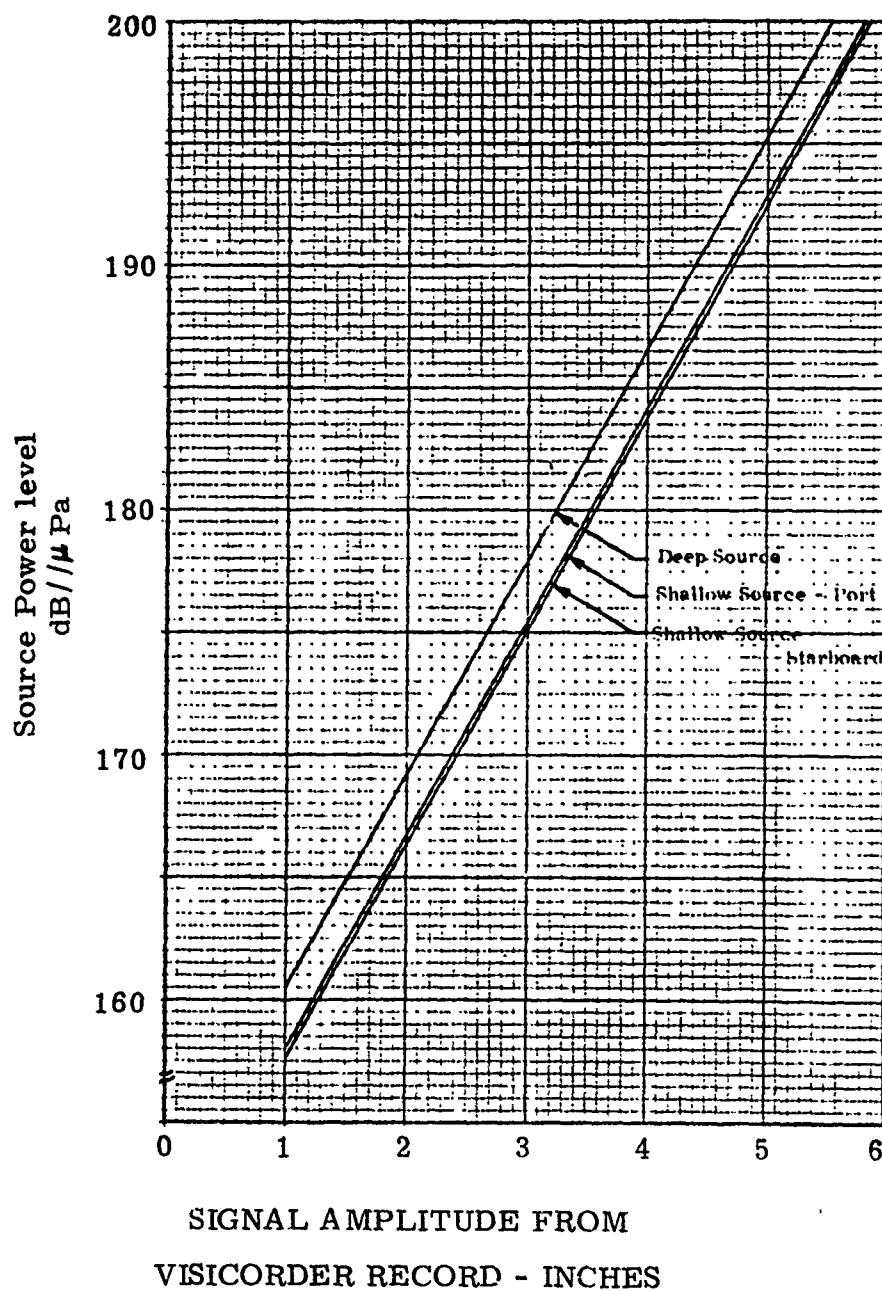


FIGURE 12

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VIBROSEIS SYSTEM
CALIBRATION CURVE
For 38 Hz Transmission

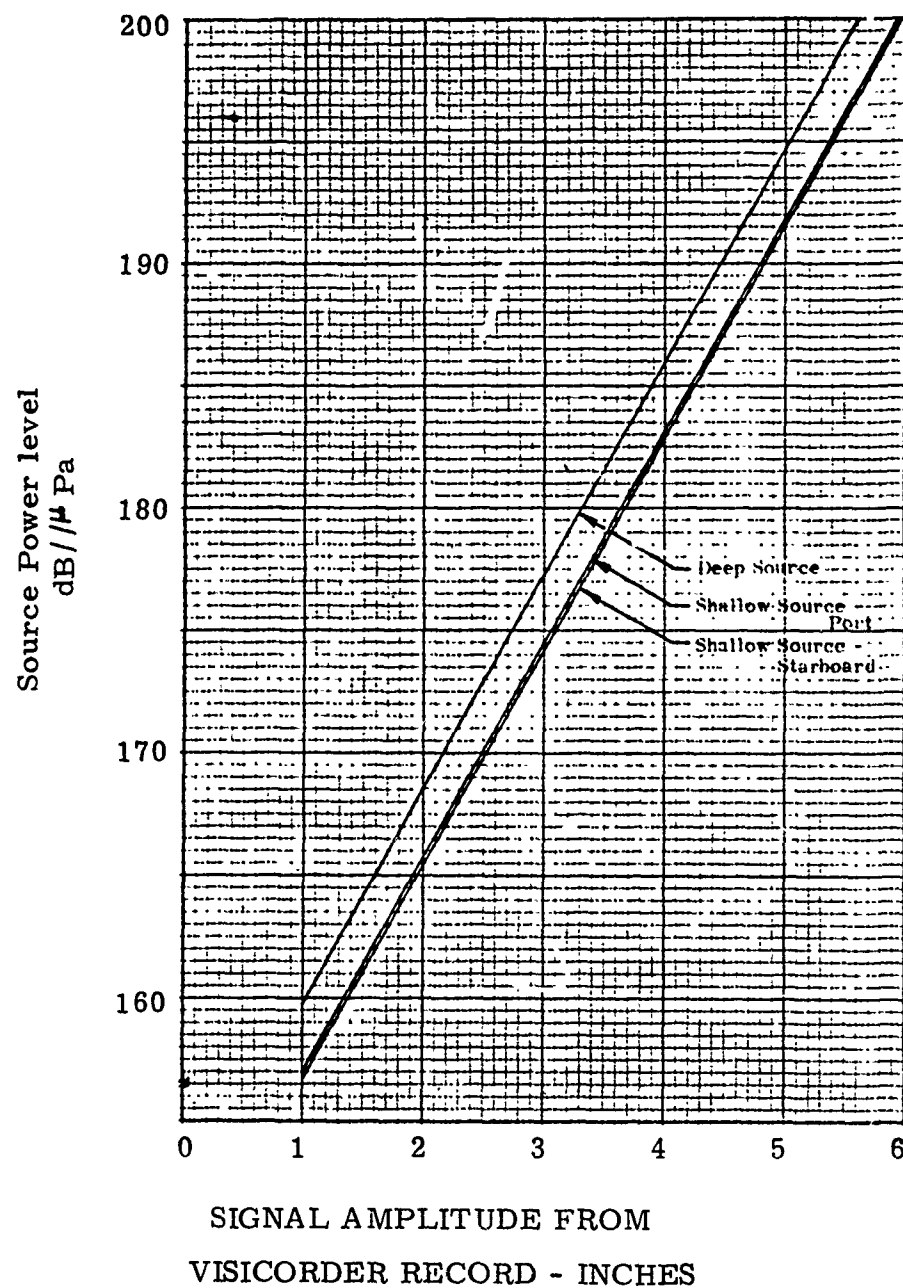


FIGURE 13

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VIBROSEIS SYSTEM
CALIBRATION CURVE
For 100 Hz Transmission

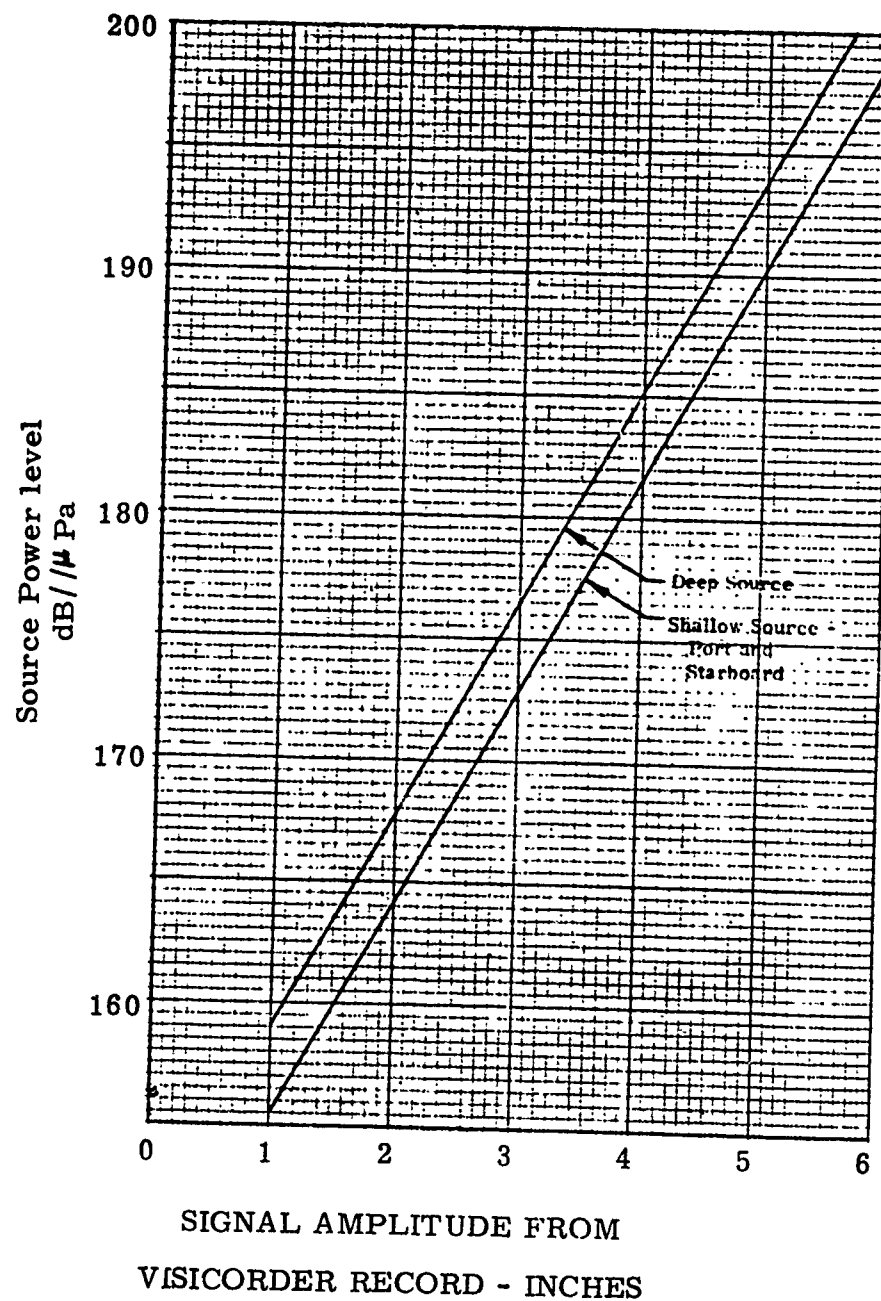


FIGURE 14

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4. SAMPLE DATA REDUCTION

A sample of the data to be reduced is presented in Figure 15. It is a reproduction of the visicorder output. Note that there was a scale change in the reproduction process. Actual measurements were made from the original hard copy of the signal spectrum recording.

The data reduction procedure used was as follows:

- a. Measure vertical displacement of fundamental signal in inches

5.14 inches

- b. Convert to source level using calibration curve for 38 Hz transmission (Figure 13, page II-13)

Therefore, 5.14 inches = 192.8 dB/ μ Pa

- c. Record transmission on transmission schedule table

from 270600Z Sept 1973

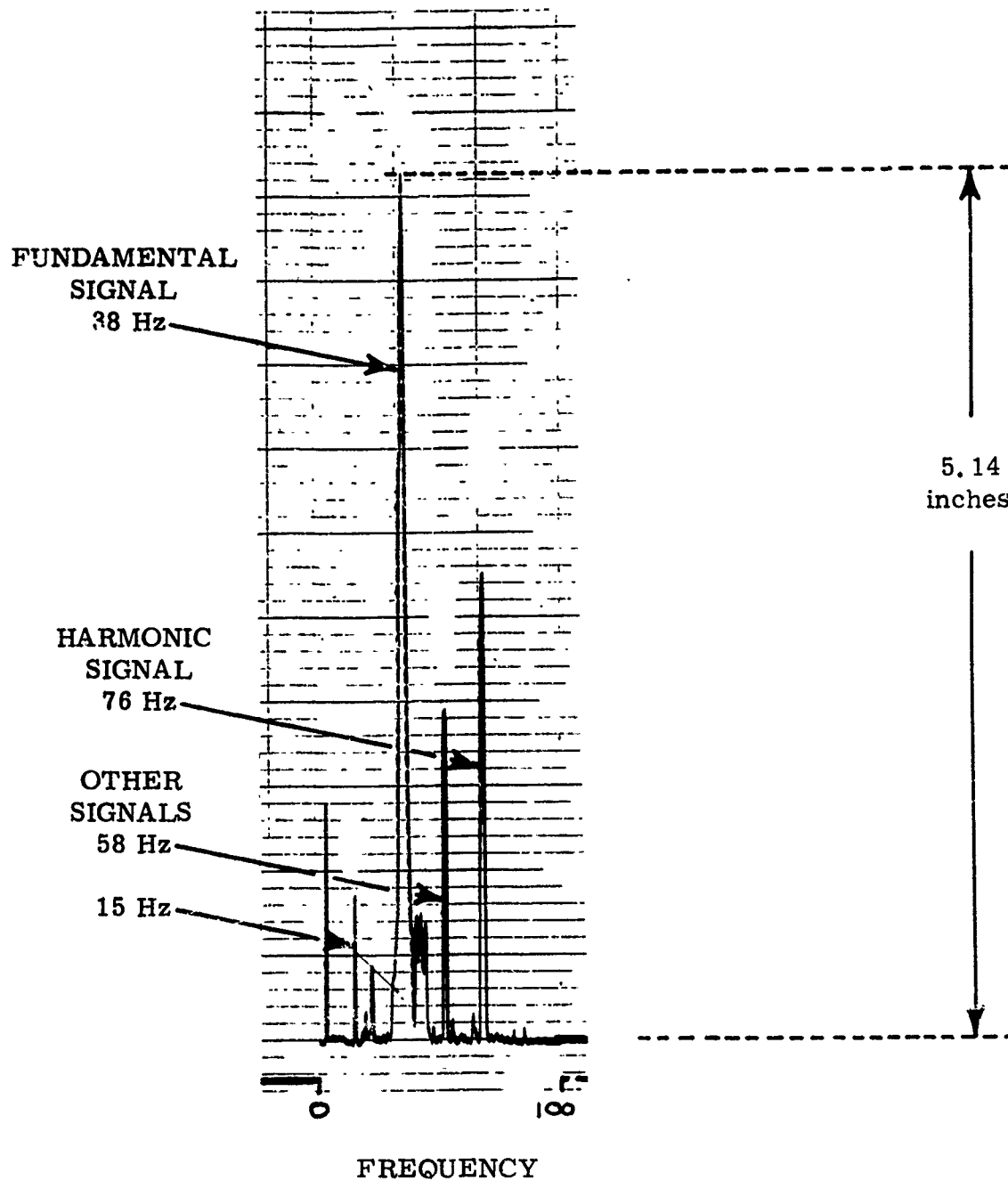
to 270620Z Sept 1973

at 193 dB/ μ Pa (value was rounded off to whole dB)

See table 58, page III-212

- d. Record on source level versus time plot. See data point 270616 SEPT on Figure 130, page III 215

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EVENT MS 0 INBOUND TOW
SHALLOW STARBOARD SOURCE
270616Z SEPT 1973

FIGURE 15
II-16

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III. VIBROSEIS SOURCE TRANSMISSION LOG

1. FORMAT OF PRESENTATION

Each transmission "event" is presented in sequence. Each event description includes a summary sheet, source transmission table, source transmission figure, a representative sample of signal spectrum, and a time/position table of the vessel during the event. A detailed description of each section is presented below.

a. Summary Sheet

The exercise event number (as assigned in the CHURCH ANCHOR Exercise Plan), the event title, and the Data Analysis Plan experiment number (as assigned in the CHURCH ANCHOR Data Analysis Plan), is presented as a heading. A general schedule of the source transmission is presented for both sources giving transmission frequencies and ON/OFF times. Slight deviations in the transmission schedule are presented in the source transmission table. A brief summary of the event is also given.

b. Source Transmission Table

The transmission table for the individual source includes exact source ON time, frequency of fundamental signal, source power level, depth, and appropriate remarks. The frequency of the harmonics and other signals can be obtained from the spectrum recordings. The source power level is the corrected value rounded off to the nearest dB.

c. Source Transmission Figure

A plot of source power level versus time is presented for the complete transmission period. It must be reiterated that the plot is based on source power levels derived from the signal spectrum recordings. The data point is the power level at the particular time indicated. Transit from one data point to another is assumed to be linear because, during the transmission, the Vibroseis source control instrumentation was continually monitored and fine tuned when required, to maintain the scheduled source power level. The value of these plots is to present the user of the data an approximation of the variation in the signal strength level during the complete transmission. In most cases, the source transmitted at a mean level with a variation of ± 1 dB.

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d. Sample Spectrum Recording

This is a reproduction of the Spectral Dynamics SD 330 spectrum recording of the transmitted signal. It can be considered to be a representative sample of the source signal during the event. The frequency of the harmonic and other signals designated on the reproduced sample were measured on the SD 330 spectrum analyzer and manually recorded on the hard copy. The horizontal axis of the spectrum recording is frequency, but it is extremely difficult to obtain any accurate values. Consequently, the value was recorded for the major signals (any signal up to 30 dB below the power level of the fundamental signal).

e. Time/Position Table

This table is a compilation of the time/position data obtained from the SATNAV system. It presents a detailed position history of the vessel during the course of the event. Positions have been classified as either a fix (F) or dead reckoning (DR) position. The DR positions are based on the previous SATNAV F positions and have not been corrected. Consequently, there could be position errors in the order of one mile in the DR position. As a back up, the complete time/position history of the vessel as compiled by NAVOCEANO is presented in Appendix A.

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2. CROSS INDEX OF EVENTS

A table cross indexing the Exercise Plan event number and the Data Analysis Plan Experiment number is presented below for quick location of desired data.

TABLE 5

<u>Event Description</u>	<u>Exercise Plan Event No.</u>	<u>Data Analysis Plan Experiment Event No.</u>
OUTBOUND STATIC	MS 002	1
OUTBOUND TOW	MS 003	1
STATIC	MS 005B	2
SOUTH ROSE - LEG 1	MS 007	7
SOUTH ROSE - LEG 2	MS 009	8
SOUTH ROSE - LEG 4	MS 013	9
SOUTH ROSE - LEG 5	MS 017	10
NORTH ROSE - LEG 1	MS 021	13
NORTH ROSE - LEG 2	MS 025	14
NORTH ROSE - LEG 3	MS 027	15
DEPTH CYCLE DOWN	MS 031'	18
DEPTH CYCLE UP	MS 031'	18
POWER CYCLE	MS 031'	19
K-A TOW	MS 036	21
K-A STATIC	MS 037	22
K-A TOW	MS 038	23
K-A STATIC	MS 039	24
BASELINE TOW	MS α	26
INBOUND TOW	MS β	33
INBOUND TOW	MS θ	33

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3. TRANSMISSION LOG

EVENT MS 002

OUTBOUND STATIC TRANSMISSION

(Data Analysis Plan Experiment Number 1)

Schedule

Shallow Source (starboard)
290300Z Aug to 290755Z Aug
11, 23, 38, 100 Hz 10 minutes ON/5 minutes
OFF at five increasing source power
levels starting on the hour

Deep Source
312045Z Aug to 010040Z Sept
11, 23, 38, 100 Hz, 10 minutes ON/5 minutes
OFF at four increasing power levels
starting at one quarter before the hour
Note: Deep Source did transmit from 291900Z
Aug to 291955Z Aug at 100 Hz and four
power levels

Summary

The power levels were supposed to remain constant during a 60 minute period while the source transmitted at four different frequencies. This was not achieved because of the low frequency roll off characteristic of the hydrophone.

The shallow source signal was very clear, with the fundamental and first and second harmonic along with the 60 Hz signal displayed on the spectrum recording.

The deep source signal was not "clean", meaning there were numerous extraneous and harmonic signals being displayed on the spectrum recording. The log display was used on the SD 330 making the quantitative evaluation of harmonic signals very difficult.

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TABLE 6

EVENT NO. MS 002

OUTBOUND STATIC

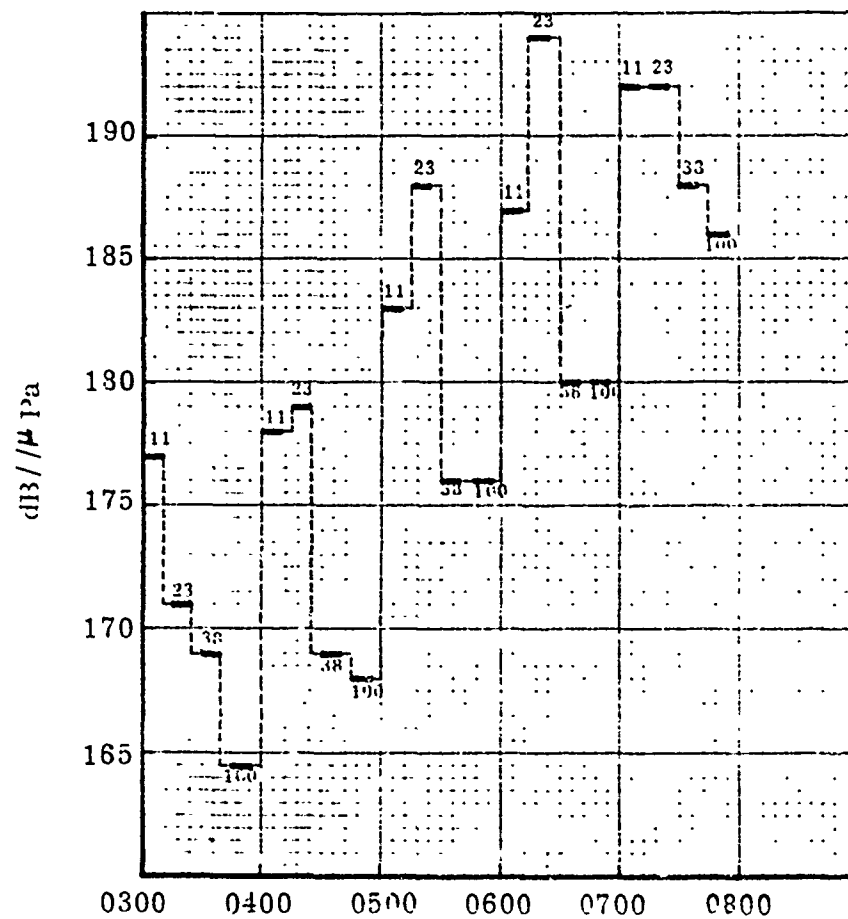
SHALLOW SOURCE

TIME GMT AUG 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
290300 to 290310	11	177	19	Turned OFF for approximately one minute at 0420
290315 to 290325	23	171	19	
290330 to 290340	38	170	19	
290345 to 290355	100	164	19	
290400 to 290410	11	178	19	
290415 to 290425	23		19	
290430 to 290430	38	169	19	
290445 to 290455	100	168	19	
290500 to 290510	11	183	19	
290515 to 290525	23	188	19	
290530 to 290540	38	176	19	
290545 to 290555	100	176	19	
290600 to 290610	11	187	19	
290615 to 290625	23	194	19	
290630 to 290640	38	180	19	
290645 to 290655	100	180	19	
290700 to 290710	11	192	19	
290715 to 290725	23	188	19	
290730 to 290740	38	186	19	End of transmission
290745 to 290755	100	186	19	
				Note: The omission of the SPL value indicates the signal was not measured at this time. An estimated value may be obtained from the SPL vs Time plots

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EVENT MS 002
OUTBOUND STATIC
SHALLOW STARBOARD SOURCE



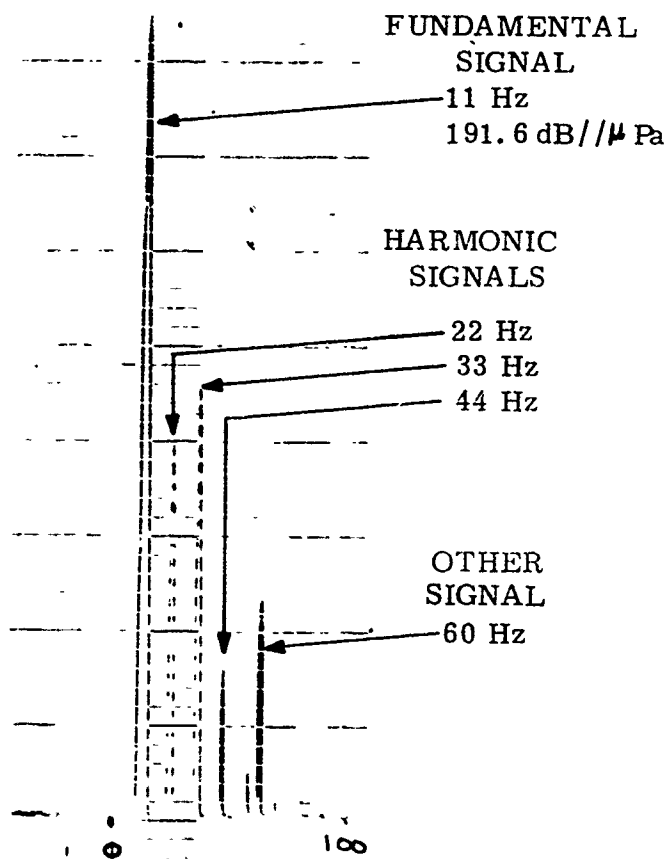
TIME
GMT 29 Aug 1973

FIGURE 16

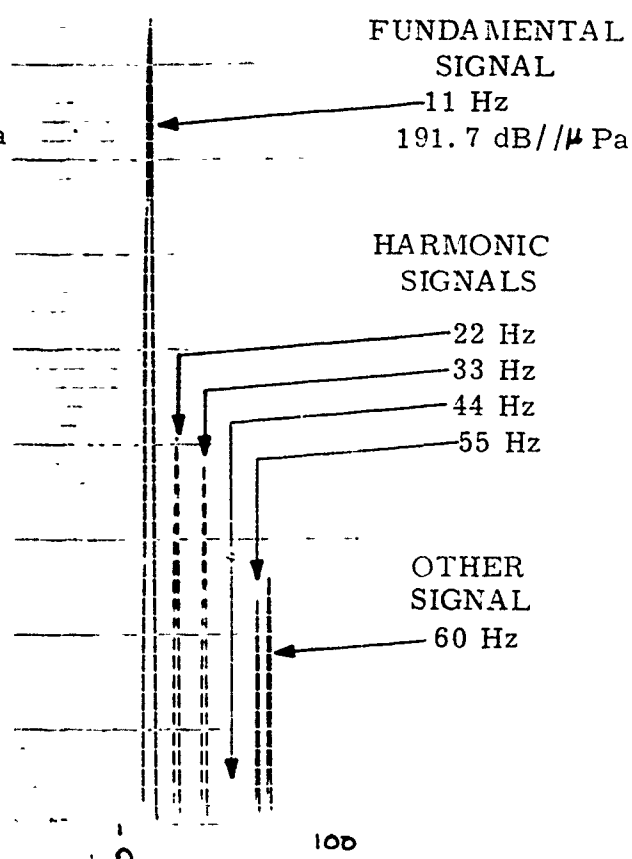
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EVENT MS 002
OUTBOUND STATIC TRANSMISSION
(DATA ANALYSIS EXPERIMENT NUMBER 1)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
290704Z AUG 1973



FREQUENCY
290707Z AUG 1973

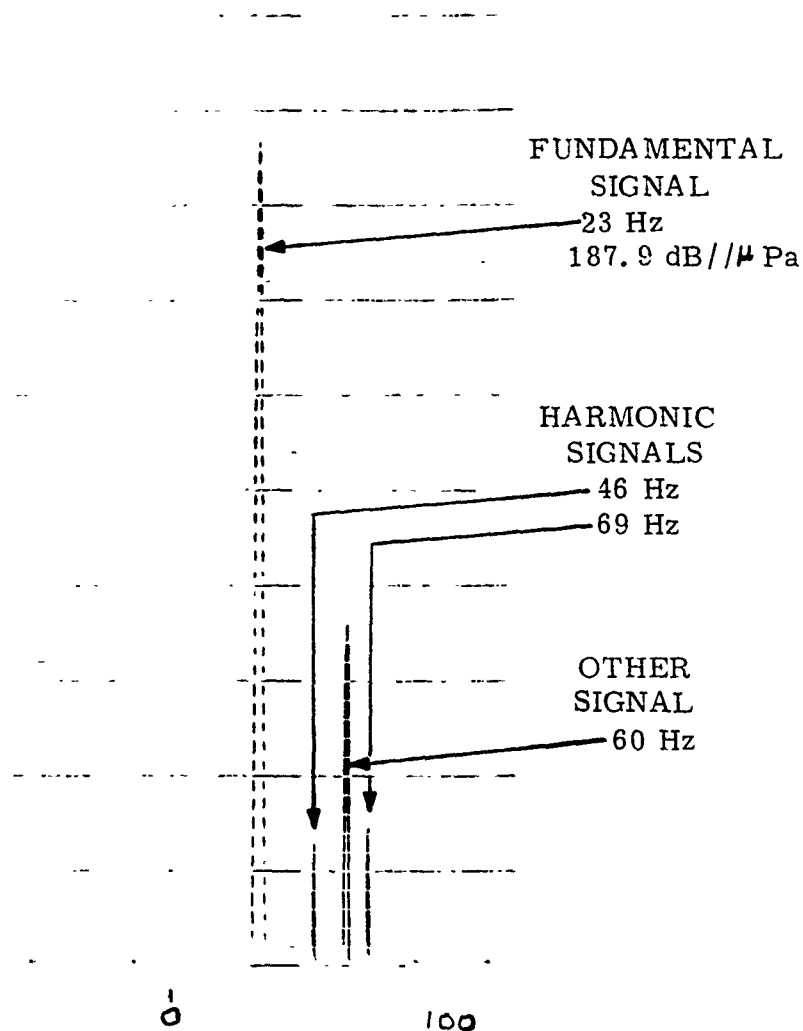
SHALLOW SOURCE

FIGURE 17

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EVENT MS 002
OUTBOUND STATIC TRANSMISSION
(DATA ANALYSIS EXPERIMENT NUMBER 1)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
290720Z AUG 1973

SHALLOW SOURCE

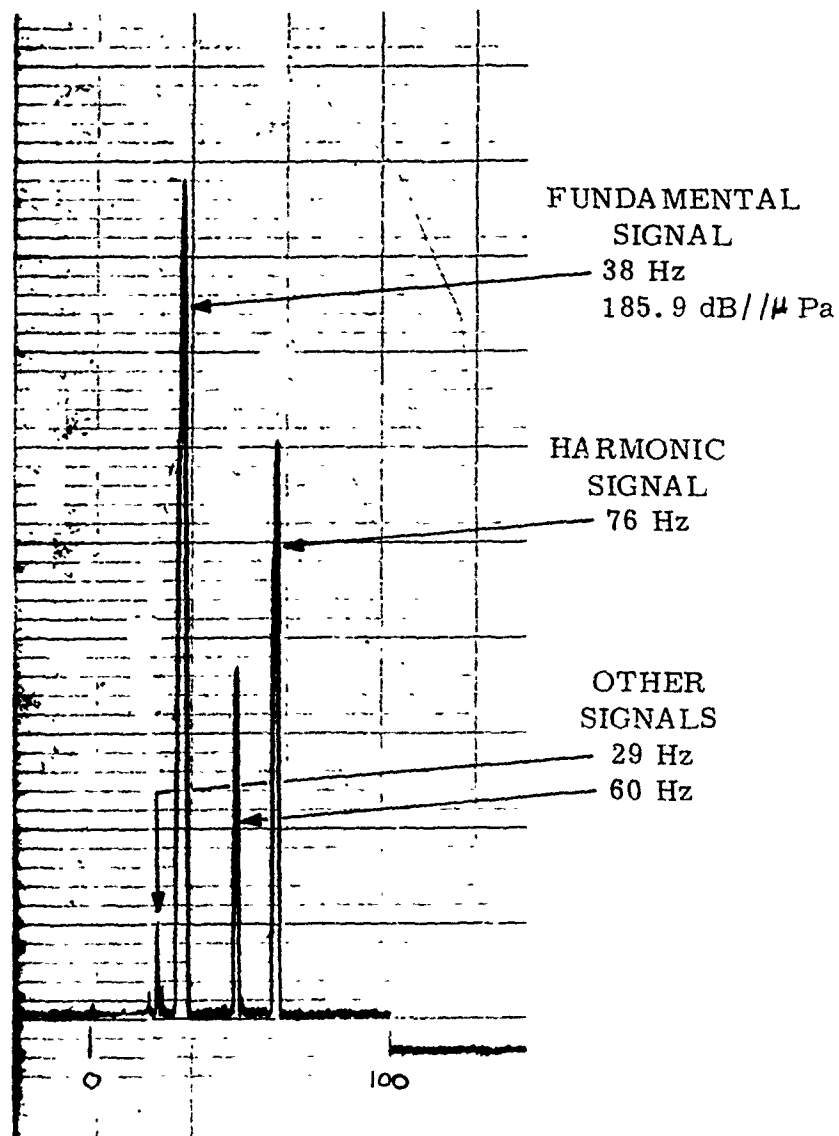
FIGURE 18

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EVENT MS 002
OUTBOUND STATIC TRANSMISSION
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 1)
SAMPLE SIGNAL SPECTRUM RECORDING



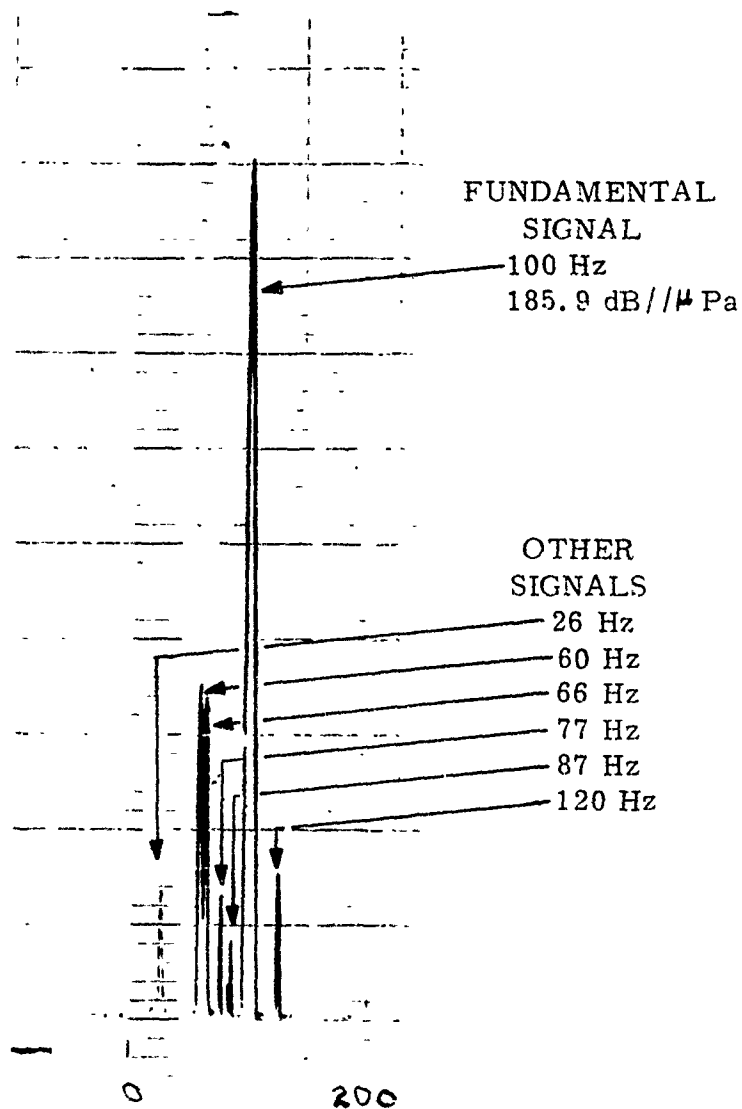
FREQUENCY
290730Z AUG 1973
SHALLOW SOURCE
FIGURE 19

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EVENT MS 002
OUTBOUND STATIC TRANSMISSION
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 1)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

290745Z AUG 1973

SHALLOW SOURCE

FIGURE 20

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TABLE 7

EVENT NO. MS 002
OUTBOUND STATIC

DEEP SOURCE

TIME GMT AUG-SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
291900 to 291910	100	165	117	Transmission terminated due to equipment problems.
291915 to 291925	100	170	120	
291930 to 291940	100	176		
291945 to 291955	100	184		
312045 to 312055	11		110	(OFF from 0008 to 000840 by accident) End of transmission.
312100 to 312102	23			
312106 to 312110	23	184		
312115 to 312125	38	181		
312130 to 312140	100	177		
312145 to 312155	11	183		
312200 to 312204	23			
312209 to 312210	23			
312215 to 312225	38	184		
312230 to 312240	100	182	110	
312245 to 312255	11	181		
312300 to 312310	23	194		
312315 to 312325	38	189		
312330 to 312340	100	187	110	
312345 to 312355	11	185		
010000 to 010010	23	190		
010015 to 010025	38	192		
010030 to 010040	100	188		

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TABLE 8
EVENT MS 002
TIME/POSITION OF VESSEL

TIME GMT AUG-SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
290300 AUG	DR*	38° 07. 7'	130° 36. 9'
290400	F*	38° 07. 3'	130° 37. 0'
290415	F	38° 07. 0'	130° 37. 8'
290452	DR	38° 07. 0'	130° 35. 8'
290500	DR	38° 07. 0'	130° 35. 7'
290528	F	38° 05. 2'	130° 36. 8'
291900	F	38° 06. 3'	130° 36. 4'
312045	DR	38° 04. 6'	134° 45. 1'
312145	DR	38° 03. 5'	134° 44. 9'
312225	F	38° 02. 6'	134° 44. 2'
312255	F	38° 02. 3'	134° 43. 4'
312325	F	38° 02. 0'	134° 43. 8'
010015 SEPT	F	38° 01. 6'	134° 43. 2'

*DR indicates a DEAD RECKONING position update from the satellite navigation computer

*F indicates a FIX was obtained 1/2 hour or less from the time given

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EVENT MS 003

OUTBOUND TOW TRANSMISSION

(Data Analysis Plan Experiment Number 1)

Schedule

Shallow Source

292000Z Aug to 292308 Aug (Port vibrator)
300215Z Aug to 300635 Aug (Starboard vibrator)
310030Z Aug to 311733 Aug (Starboard vibrator)
38 Hz, 8 minutes ON/7 minutes OFF at a
constant power level starting on the hour

Deep Source

292000Z Aug to 292138 Aug
100 Hz, same schedule as shallow source

Summary

The transmission made with the shallow port vibrator was erratic and of questionable value. The shallow starboard source transmissions were more constant, with the same power level variations of approximately ± 1 dB. On the last shallow source transmission, the average source power level did increase by approximately 2 dB over an 18 hour period.

The deep source transmitted for one and a half hours, and the transmission was terminated because of equipment problems. It can only be guesstimated that the same power level was 179 ± 1 dB/ μ Pa because only one spectrum recording was made.

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TABLE 9
EVENT MS 003
OUTBOUND TOW

SHALLOW SOURCE

TIME GMT AUG 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
292000 to 292008	38		18	End of transmission due to leakage in system
292015 to 292023	38		18	
292030 to 292038	38		18	
292100 to 292108	38	174	18	
292115 to 292123	38		18	
292130 to 292138	38	170	18	
292200 to 292208	38	181	18	
292215 to 292223	38	181	18	
292230 to 292238	38		18	
292300 to 292308	38		18	
300215 to 300223	38	182	18	Late turning OFF by 1 minute
300230 to 300238	38	182	18	
300300 to 300309	38	182	18	
300315 to 300323	38	181	18	
300330 to 300338	38	183	18	
300400 to 300408	38	181	18	
300415 to 300423	38	183	18	
300430 to 300438	38	181	18	
300500 to 300508	38	181	18	
300515 to 300523	38	181	18	
300530 to 300538	38	182	18	
300600 to 300608	38	185	18	
300615 to 300623	38		18	
300630 to 300635	38	182	18	
310030 to 310038	38	179	18	End of transmission due to equipment problems.
310100 to 310108	38	180	18	
310115 to 310123	38	180	18	
310130 to 310138	38	181	18	
310200 to 310208	38	181	18	
310215 to 310223	38	180	18	
310230 to 310238	38	181	18	
310300 to 310308	38	180	18	
310315 to 310323	38	181	18	

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TABLE 9 Continued

EVENT MS 003

OUTBOUND TOW

SHALLOW SOURCE (Continued)

TIME GMT AUG 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
310330 to 310338	38	180	18	
310400 to 310408	38	180	18	
310415 to 310423	38	180	18	
310430 to 310438	38	179	18	
310500 to 310508	38	178	18	
310515 to 310523	38	179	18	
310530 to 310538	38	181	18	
310600 to 310608	38	181	18	
310615 to 310623	38	181	18	
310630 to 310638	38	181	18	
310700 to 310708	38	182	18	
310715 to 310723	38	182	18	
310730 to 310738	38	181	18	
310800 to 310808	38	180	18	
310815 to 310823	38		18	
310830 to 310838	38	180	18	
310900 to 310908	38	180	18	
310915 to 310923	38	180	18	
310930 to 310938	38	180	18	
311000 to 311008	38	180	18	
311015 to 311023	38	182	18	
311030 to 311038	38	182	18	
311100 to 311108	38	182	18	
311115 to 311123	38	182	18	
311130 to 311138	38	182	18	
311200 to 311208	38	181	18	
311215 to 311223	38	183	18	
311230 to 311238	38	180	18	
311300 to 311308	38	182	18	
311315 to 311323	38	182	18	
311330 to 311338	38	182	18	
311400 to 311408	38	181	18	
311415 to 311423	38	181	18	
311430 to 311538	38	182	18	
311500 to 311508	38	181	18	
311515 to 311523	38	181	18	
311530 to 311538	38	181	18	
311600 to 311608	38	181	18	

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TABLE 9 Continued

EVENT MS 003

OUTBOUND TOW

SHALLOW SOURCE (Continued)

TIME GMT AUG 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
311615 to 311623	38	182	18	Transmission terminated to complete Event MS 002
311630 to 311638	38	182	18	
311700 to 311708	38	182	18	
311715 to 311723	38	181	18	
311730 to 311738	38	182	18	

TABLE 10

EVENT MS 003

OUTBOUND TOW

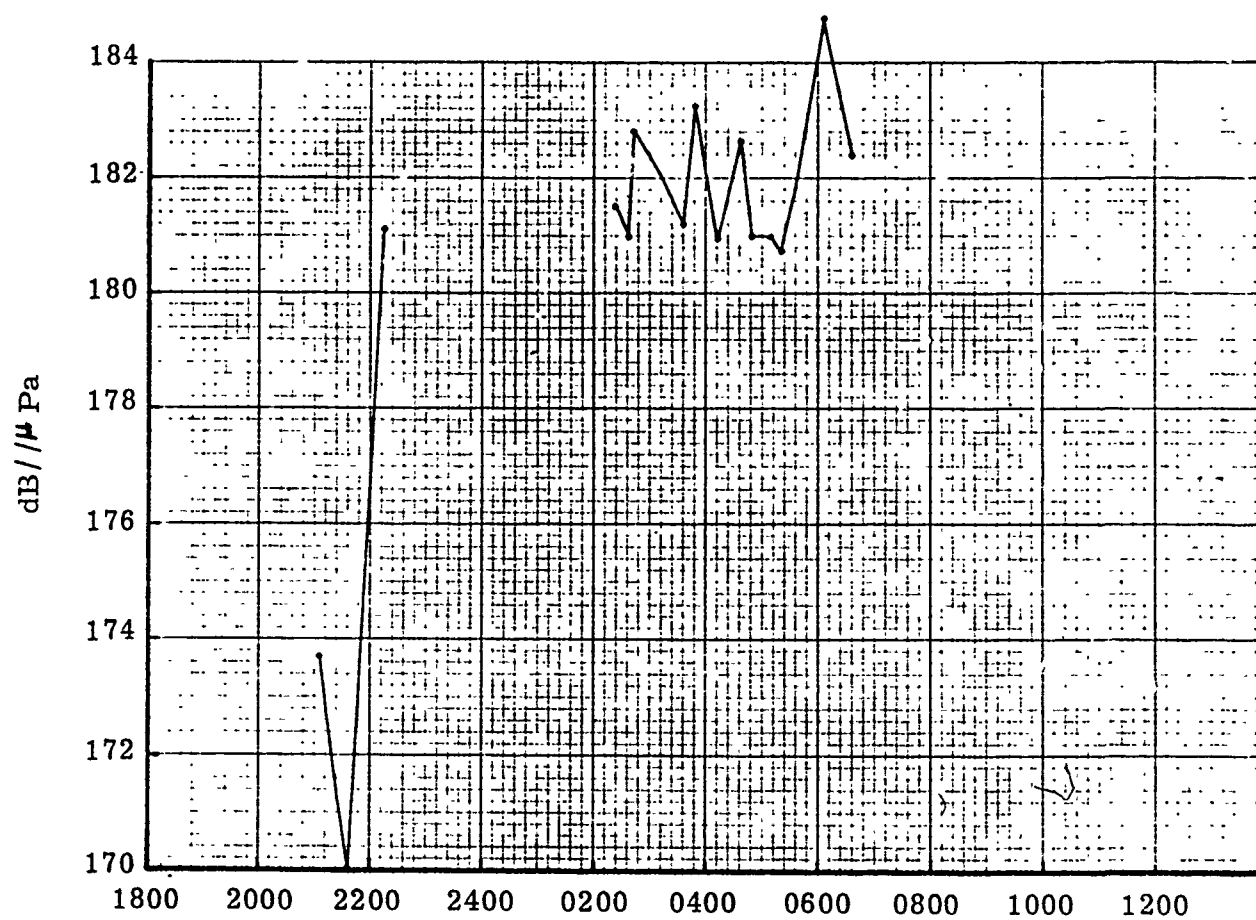
DEEP SOURCE

TIME GMT AUG 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
292000 to 292008	100	179	120	Transmission terminated, equipment problems
292015 to 292023	100			
292030 to 292038	100		119	
292045 to 292053	100			
292100 to 292108	100		119	
292115 to 292123	100			
292130 to 292138	100			

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EVENT MS 003
OUTBOUND TOW
SHALLOW SOURCE
38 Hz



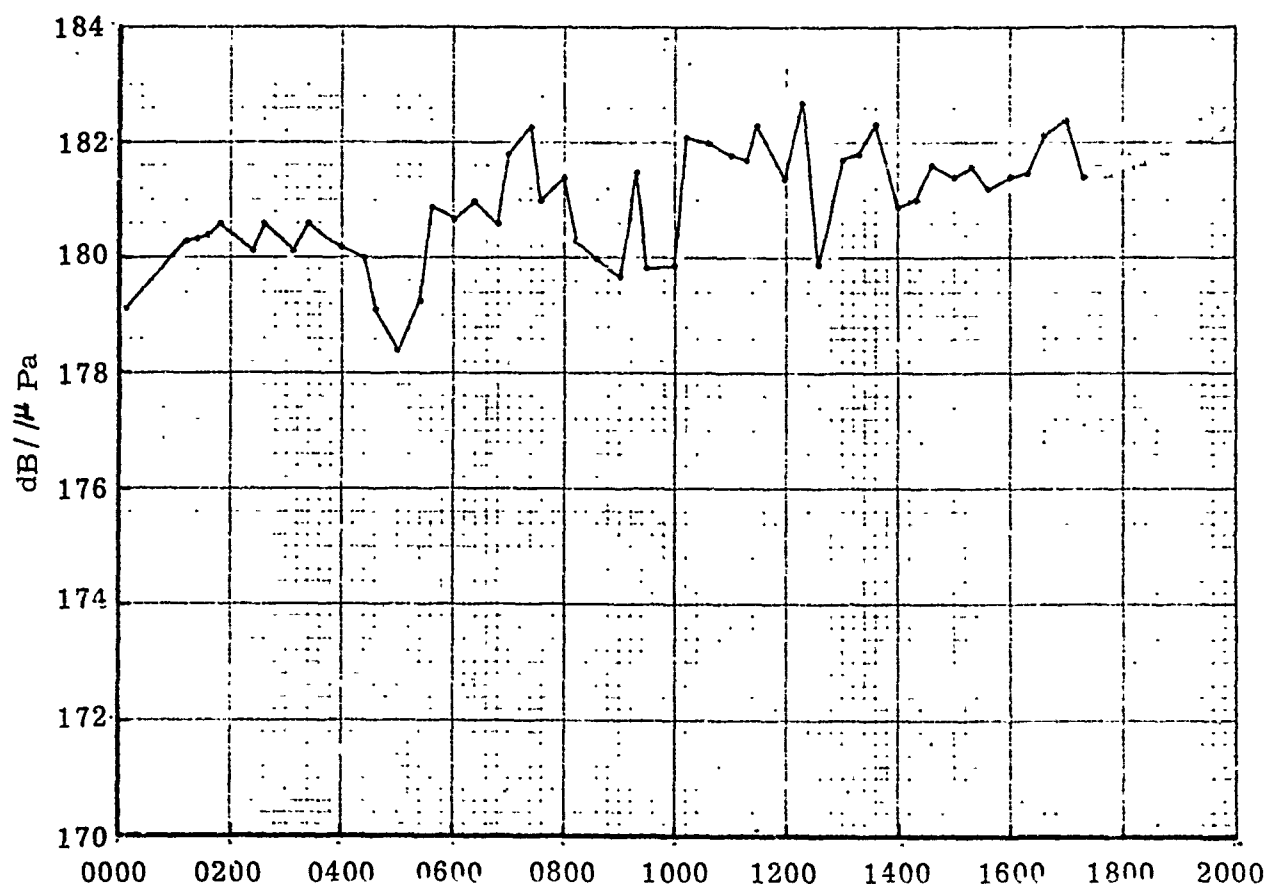
TIME
GMT 29 & 30 Aug 1973

FIGURE 22

CONFIDENTIAL

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EVENT MS 003
OUTBOUND TOW
SHALLOW SOURCE
38 Hz



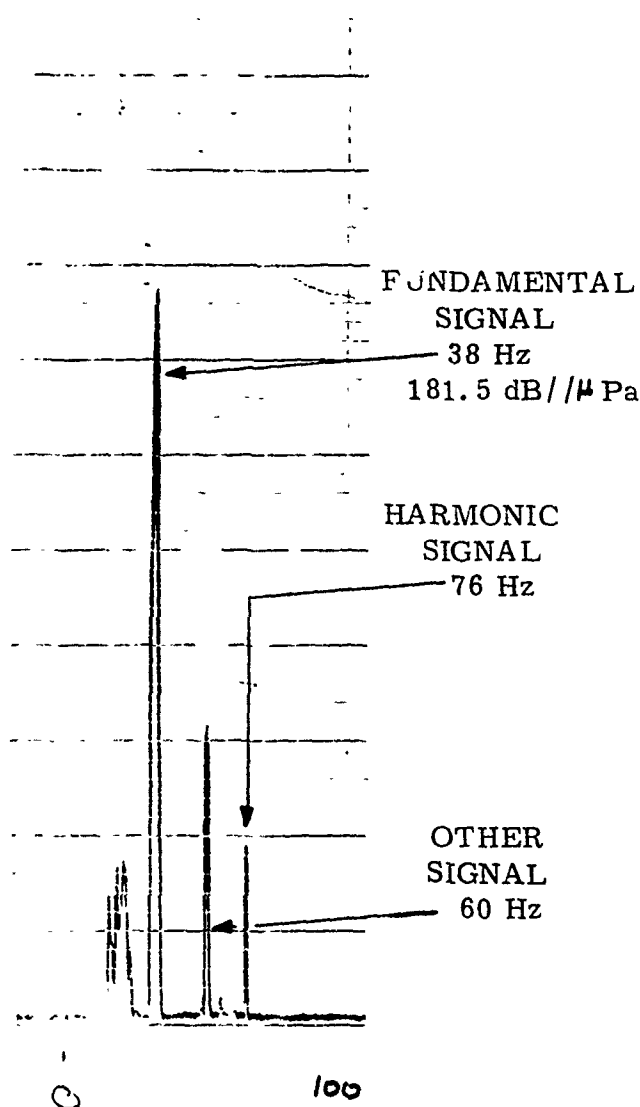
TIME
GMT 31 Aug 1973

FIGURE 23

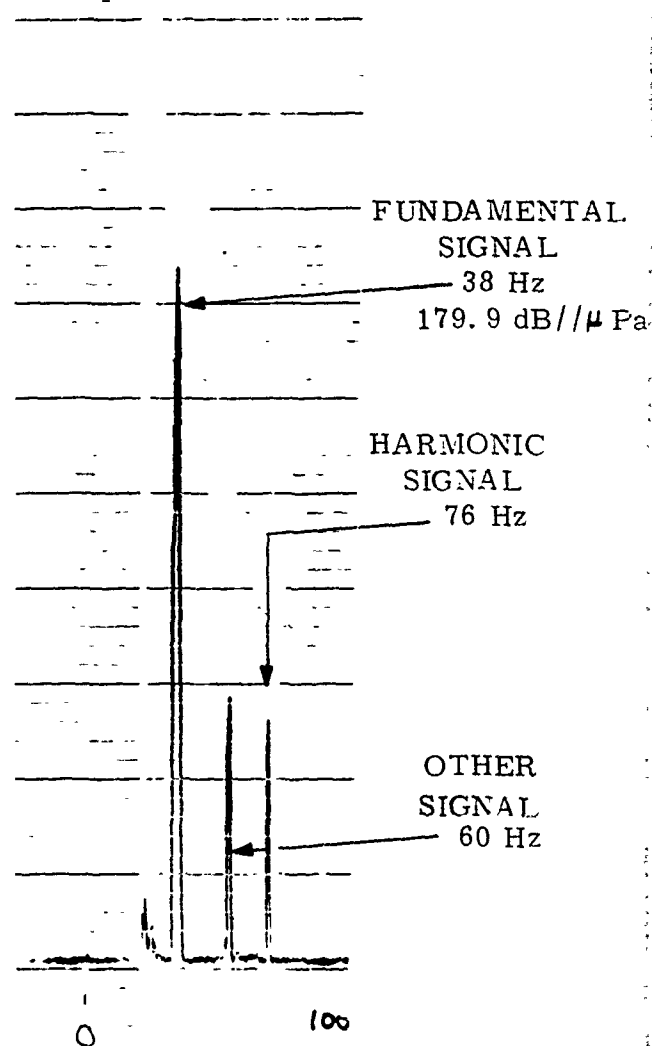
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EVENT MS 003
OUTBOUND TOW TRANSMISSION
(DATA ANALYSIS EXPERIMENT NUMBER 1)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
310915Z AUG 1973



FREQUENCY
311000Z AUG 1973

SHALLOW SOURCE
FIGURE 24

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TABLE 11
EVENT MS 003
TIME/POSITION OF VESSEL

TIME GMT AUGUST 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
292009	DR	38° 06. 2'	130° 36. 1'
292100	F	38° 04. 9'	130° 40. 1'
292145	DR	38° 05. 3'	130° 46. 2'
292252	F	38° 04. 4'	130° 58. 9'
300215	DR	38° 03. 2'	131° 04. 9'
300330	DR	38° 02. 8'	131° 10. 9'
300438	DR	38° 02. 8'	131° 18. 5'
300554	DR	38° 04. 2'	131° 26. 4'
310030	DR	38° 05. 8'	133° 06. 0'
310036	F	38° 05. 7'	133° 05. 7'
310130	DR	38° 06. 2'	133° 09. 7'
310215	DR	38° 06. 1'	133° 13. 3'
310238	F	38° 06. 1'	133° 14. 5'
310350	F	38° 05. 8'	133° 21. 5'
310410	F	38° 05. 6'	133° 23. 7'
310534	F	38° 04. 4'	133° 31. 6'
310630	DR	38° 04. 4'	133° 36. 8'
310728	F	38° 05. 0'	133° 41. 8'
310830	DR	38° 03. 3'	133° 48. 2'
310914	F	38° 02. 8'	133° 52. 8'
311008	F	38° 02. 6'	133° 58. 0'
311100	F	38° 01. 9'	134° 03. 4'
311128	F	38° 02. 0'	134° 06. 0'
311250	F	38° 01. 1'	134° 13. 7'
311340	F	38° 00. 9'	134° 17. 7'
311500	DR	38° 01. 5'	134° 25. 4'
311518	F	38° 00. 9'	134° 27. 6'
311630	DR	38° 01. 3'	134° 34. 0'
311730	DR	38° 02. 1'	134° 40. 5'

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EVENT MS 005 B

STATIC TRANSMISSION

(Data Analysis Plan Experiment Number 2)

Schedule

Shallow Source (starboard)
030000Z Sept to 031000Z Sept
38 Hz continuous transmission

Summary

The signal was slightly erratic the first two hours of transmission then leveled out to an average value of 176.5 ± 1 dB/ μ Pa.

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TABLE 12

EVENT MS 005B

STATIC TRANSMISSION

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
030000 to 031000	38	176	20	Continuous transmission for 10 hours. See plot of SPL vs time for measured SPL values.

TABLE 13

EVENT MS 005B

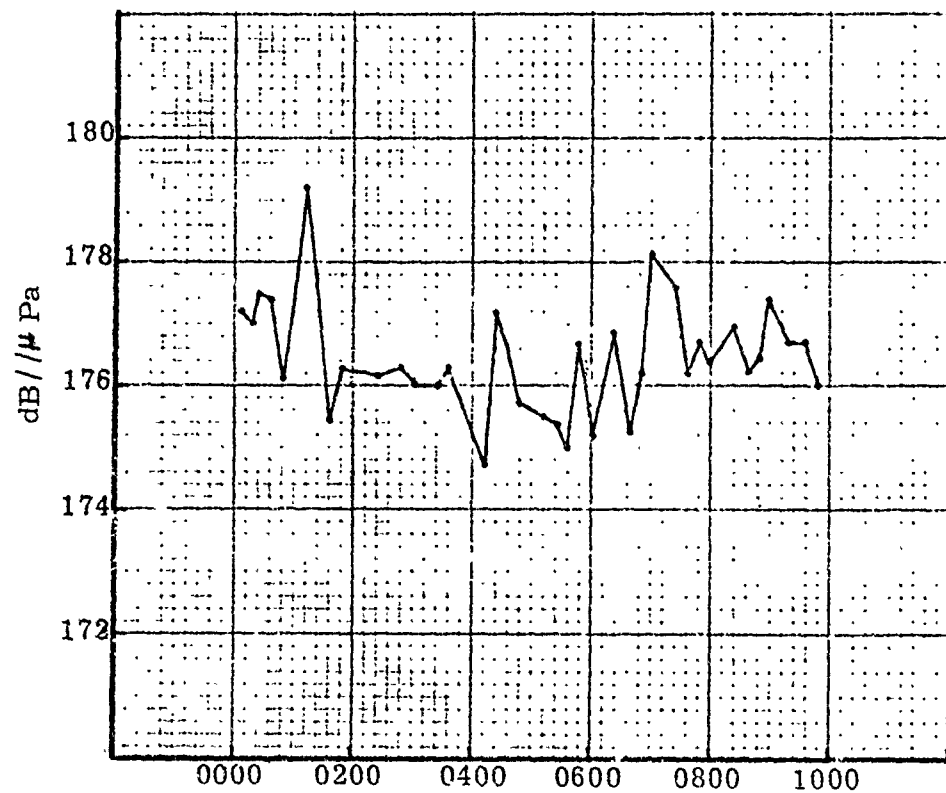
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
030000	F	36° 32.0'	142° 48.6'
030200	F	36° 31.6'	142° 49.4'
030300	F	36° 31.1'	142° 49.5'
030400	F	36° 31.3'	142° 49.5'
030515	F	36° 33.6'	142° 48.6'
030600	DR	36° 33.5'	142° 48.6'
030642	F	36° 32.5'	142° 48.6'
030716	F	36° 32.7'	142° 48.4'
030856	F	36° 31.6'	142° 48.0'

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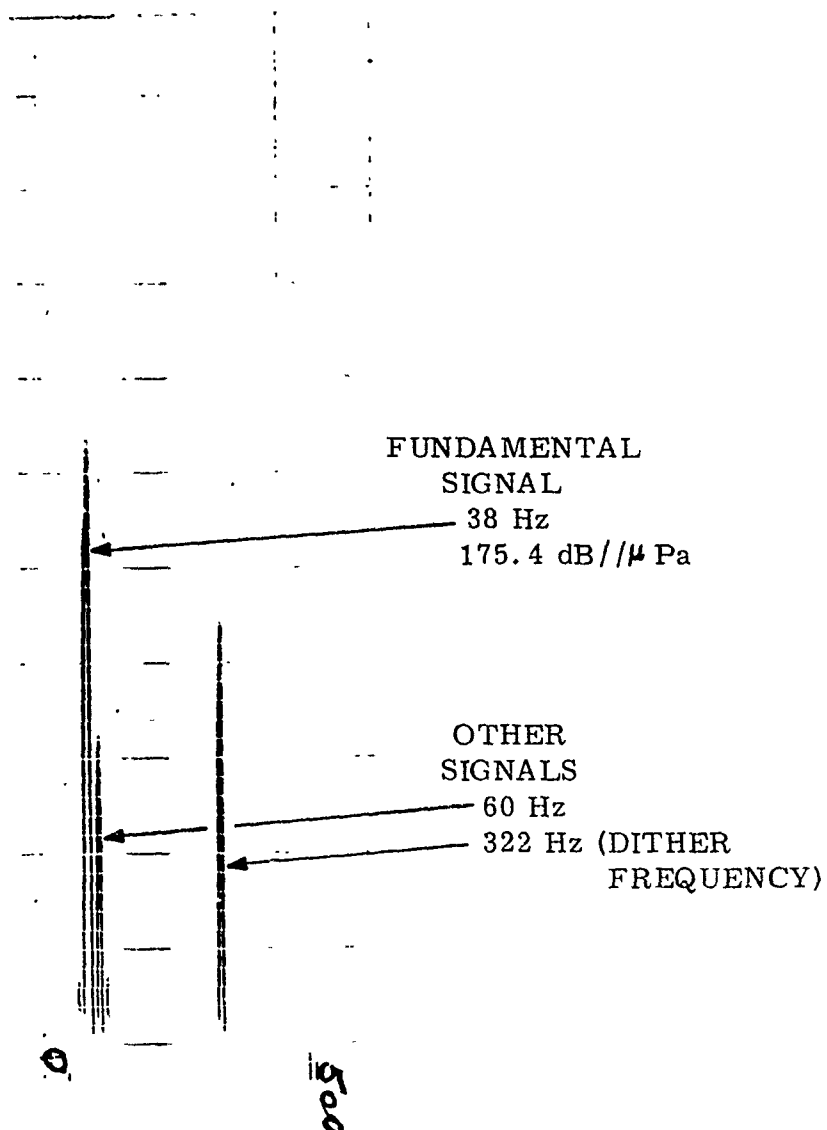
EVENT MS 005 B
STATIC
SHALLOW SOURCE
38 Hz



TIME
GMT 3 SEPT 1973
FIGURE 25

CONFIDENTIAL

EVENT MS 005B
STATIC TRANSMISSION
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 2)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

030521Z SEPT 1973

SHALLOW SOURCE

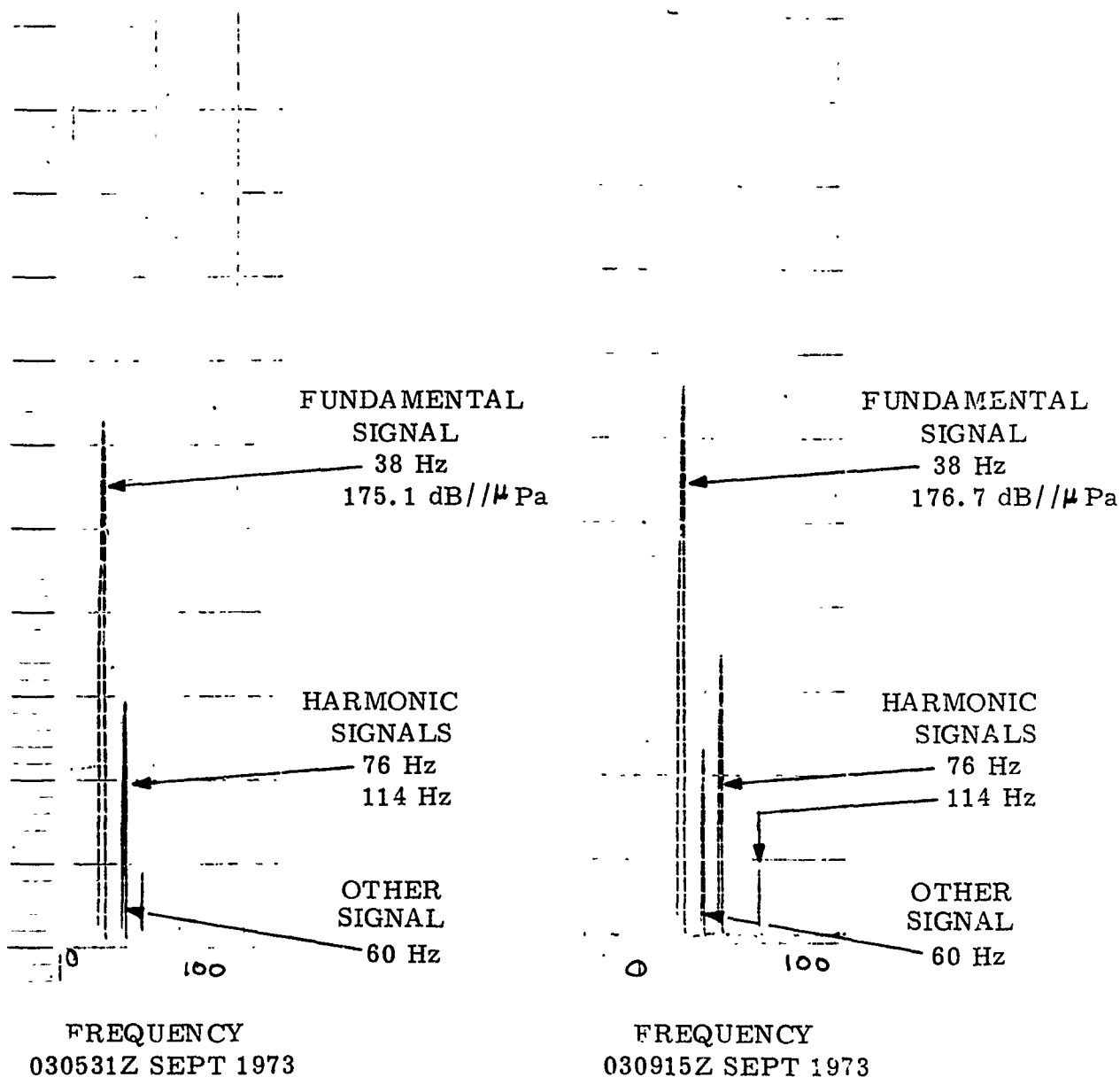
FIGURE 26

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EVENT MS 005B
STATIC TRANSMISSION
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 2)
SAMPLE SIGNAL SPECTRUM RECORDING



SHALLOW SOURCE
FIGURE 27

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EVENT MS 007

SOUTH ROSE - LEG 1

(Data Analysis Plan Experiment Number 7)

Schedule

Shallow Source (starboard)
031400Z Sept to 040755Z Sept
100 Hz, 55 minutes ON/5 minutes
OFF start on the hour

Deep Source
031400Z Sept to 040755Z Sept
38 Hz, 55 minutes ON/5 minutes
OFF start on the hour

Summary

Both shallow and deep sources levels relatively constant even though the signal spectrum recordings indicated numerous harmonics and extraneous signals.

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TABLE 14

EVENT MS 007

SOUTH ROSE LEG 1

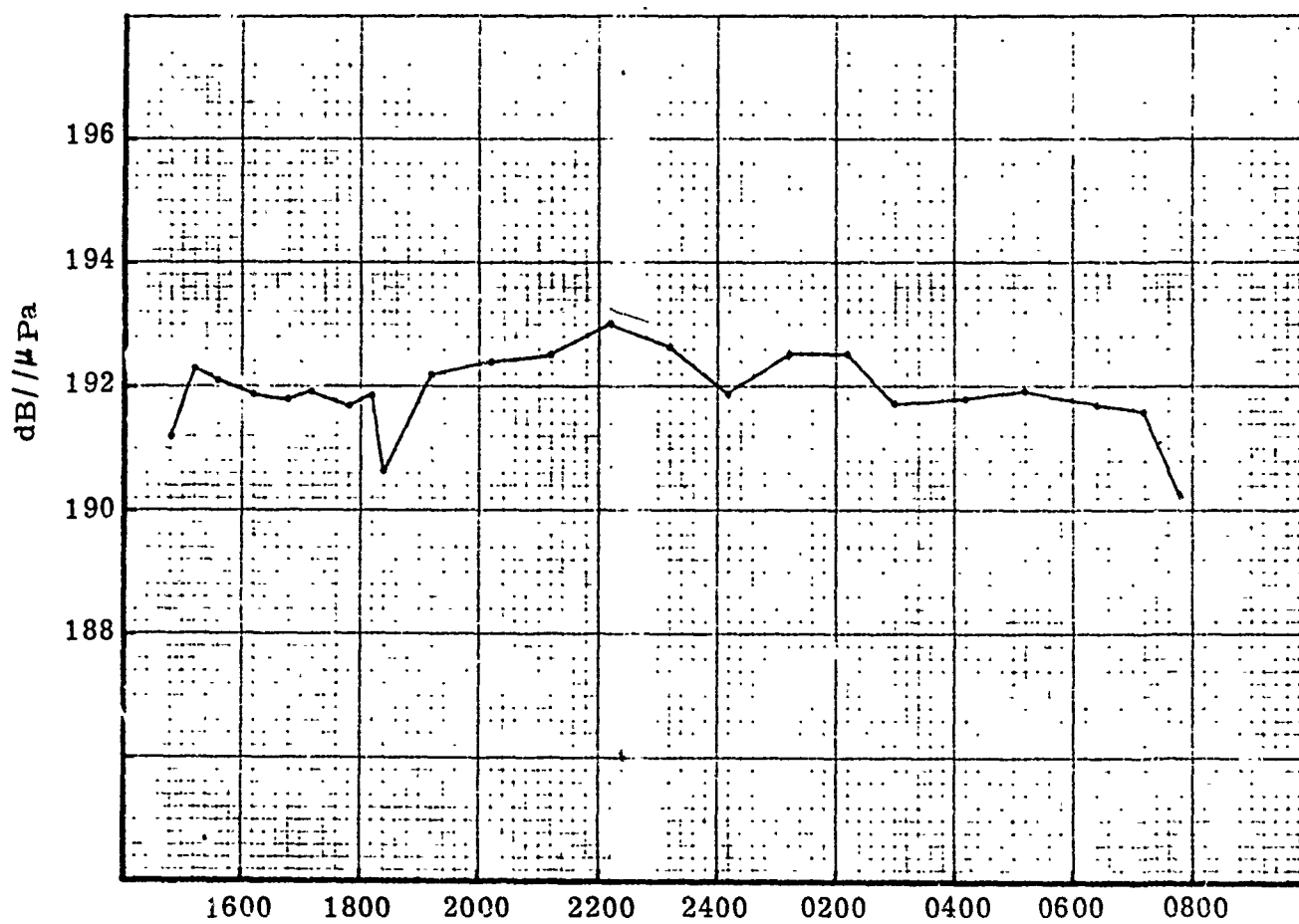
SHALLOW SOURCE

TIME GMT SEPT 197	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
031400 to 031435	38	192	19	Shut off 1 1/2 minutes late
031435 to 031455	100	191	19	
031500 to 031555	100	192	19	
031600 to 031655	100	192	19	
031700 to 031755	100	192	19	
031800 to 031855	100	191	19	
031900 to 031956.30	100	192	19	
032000 to 032055	100	192	19	
032100 to 032155	100	193	19	
032200 to 032255	100	193	19	
032300 to 032355	100	193	19	
040000 to 040055	100	192	19	
040100 to 040155	100	193	19	
040200 to 040255	100	193	19	
040300 to 040355	100	192	19	
040400 to 040455	100	192	19	
040500 to 040555	100	192	19	
040600 to 040655	100	192	19	
040700 to 040755	100	192	19	

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EVENT MS 007
SOUTH ROSE LEG 1
SHALLOW SOURCE
100 Hz



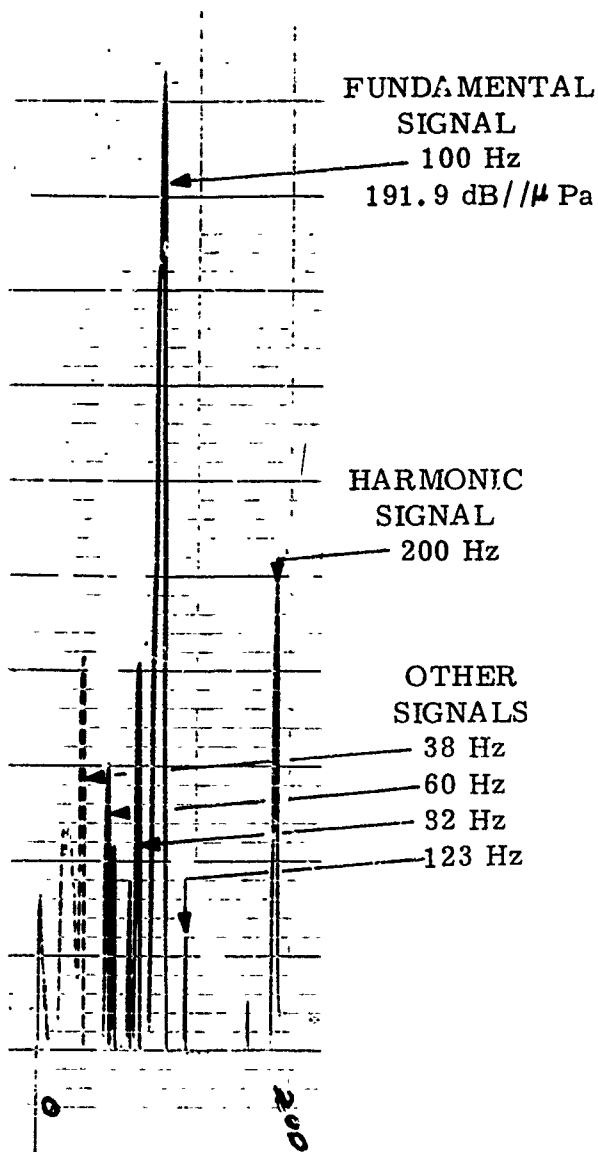
TIME
GMT 3 & 4 Sept 1973

FIGURE 28

CONFIDENTIAL

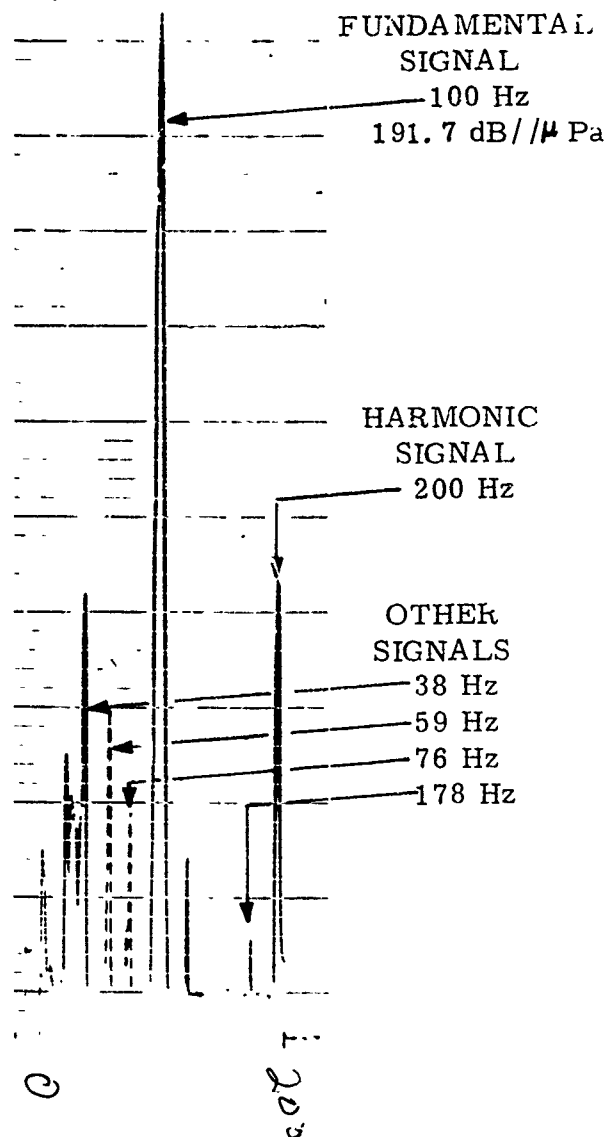
CONFIDENTIAL

EVENT MS 007
SOUTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 7)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

031710Z SEPT 1973



FREQUENCY

031748Z SEPT 1973

SHALLOW SOURCE

FIGURE 29
III-32

CONFIDENTIAL

CONFIDENTIAL

TABLE 15
EVENT MS 007
SOUTH ROSE LEG 1

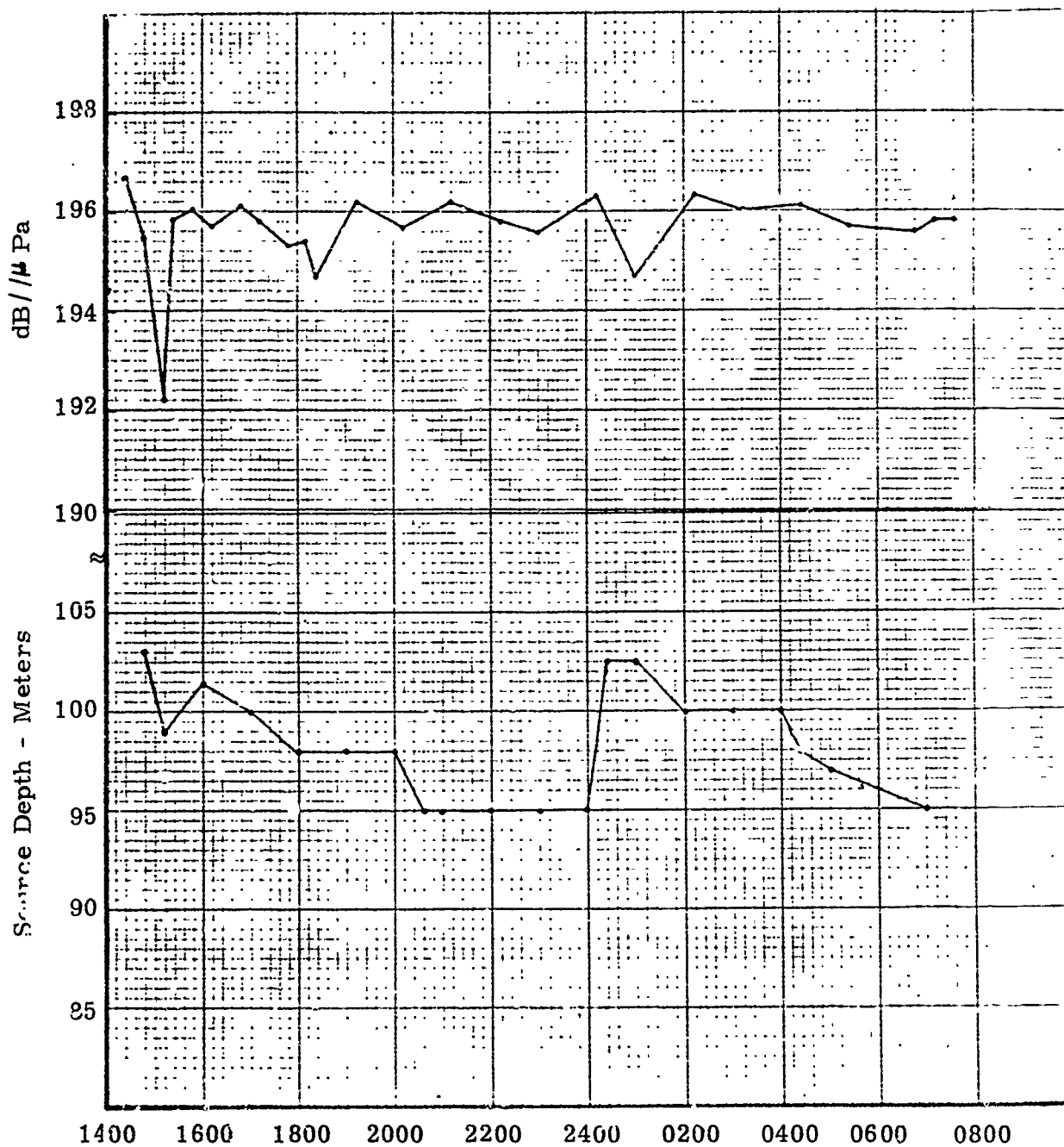
DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
031400 to 031435	100		103	Transmitted on wrong frequency
031435 to 031455	38	197	103	
031500 to 031555	38	195	99	
031600 to 031655	38	196	101	
031700 to 031755	38	196	100	Shut OFF 1'30" late
031800 to 031855	38	195	98	
031900 to 031956.30	38	196	98	
032000 to 032055	38	196	98	
032100 to 032155	38	196	95	
032200 to 032255	38	196	95	
032300 to 032355	38	196	95	
040000 to 040055	38	196	101	
040100 to 040155	38	195	101	
040200 to 040255	38	196	100	
040300 to 040355	38	196	100	
040400 to 040455	38	196	100	
040500 to 040555	38	196	97	End of Event MS 007
040600 to 040655	38	196		
040700 to 040755	38	196	95	

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EVENT MS 007
SOUTH ROSE - LEG 1
DEEP SOURCE
38 Hz

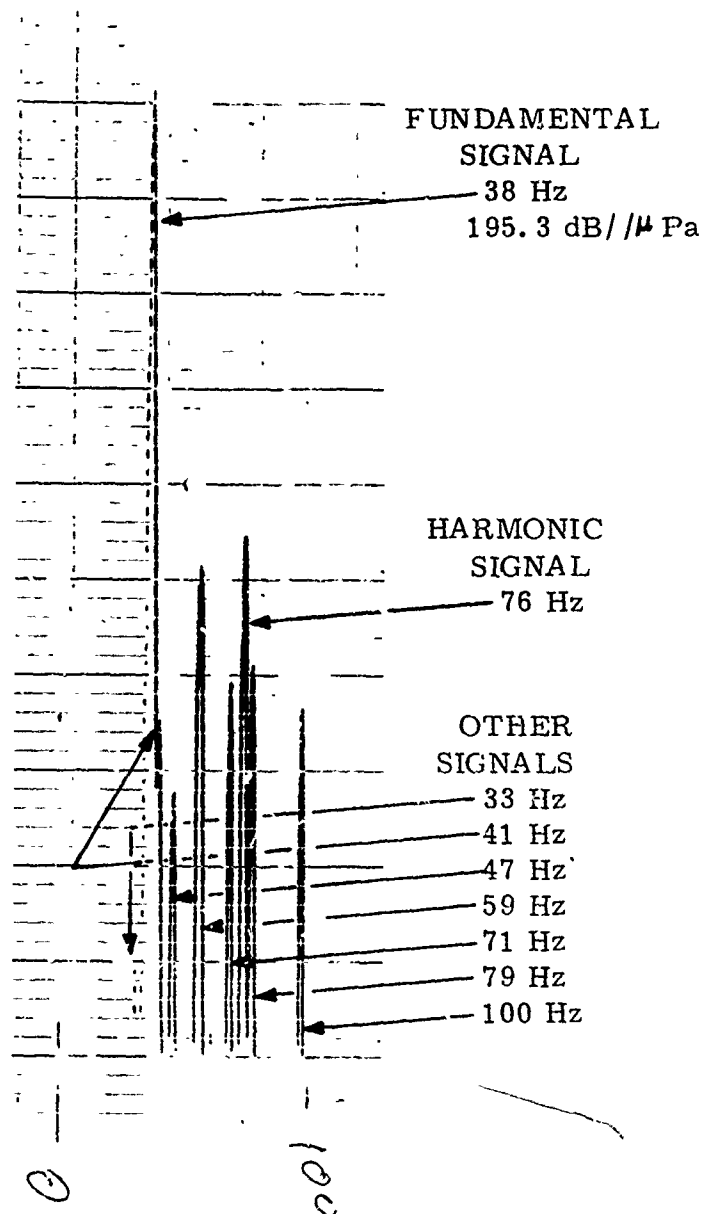


TIME
GMT 3 & 4 Sept 1973
FIGURE 30
III-34

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EVENT MS 007
SOUTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 7)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

031745Z SEPT 1973

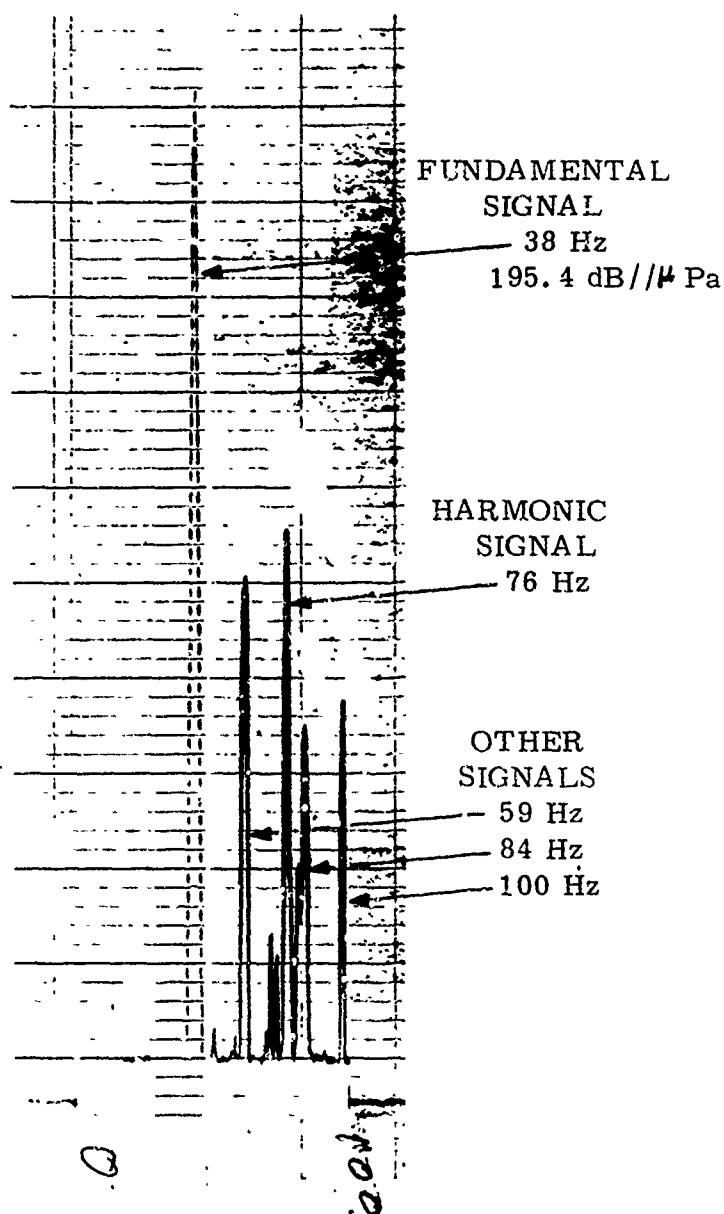
DEEP SOURCE

FIGURE 31
III-35

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EVENT MS 007
SOUTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 7)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

031808Z SEPT 1973

DEEP SOURCE

FIGURE 32
III-36

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TABLE 16
EVENT MS 007
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
031400	DR*	36° 32. 2'	142° 48. 1'
031539	DR*	36° 28. 8'	142° 54. 3'
031600	DR*	36° 27. 6'	142° 56. 1'
031701	DR*	36° 25. 2'	143° 00. 3'
032010	F	36° 16. 9'	143° 15. 9'
032100	DR	36° 14. 7'	143° 19. 9'
032200	DR	36° 12. 2'	143° 24. 5'
032300	DR	36° 09. 3'	143° 24. 4'
040000	F	36° 07. 1'	143° 33. 7'
040100	F	36° 04. 5'	143° 38. 0'
040200	DR	36° 02. 2'	143° 43. 0'
040300	F	35° 59. 1'	143° 49. 7'
040422	F	35° 56. 6'	143° 54. 6'
040552	F	35° 52. 1'	144° 03. 3'
040744	F	35° 48. 1'	144° 15. 2'

*The accuracy of these positions is questionable due to the fact that the three previous satellite passes were no good.

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EVENT MS 009

SOUTH ROSE - LEG 2

(Data Analysis Plan Experiment Number 8)

Schedule

Shallow Source (starboard)
041900Z Sept to 051355Z Sept
100 Hz, 55 minutes ON/5 minutes
OFF start on the hour

Deep Source
38 Hz, 55 minutes ON/5 minutes
OFF start on the hour

Summary

Both shallow and deep sources level relatively
constant.

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III-39

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CONFIDENTIALTABLE 17
EVENT MS 009

SOUTH ROSE LEG No. 2

SHALLOW SOURCE

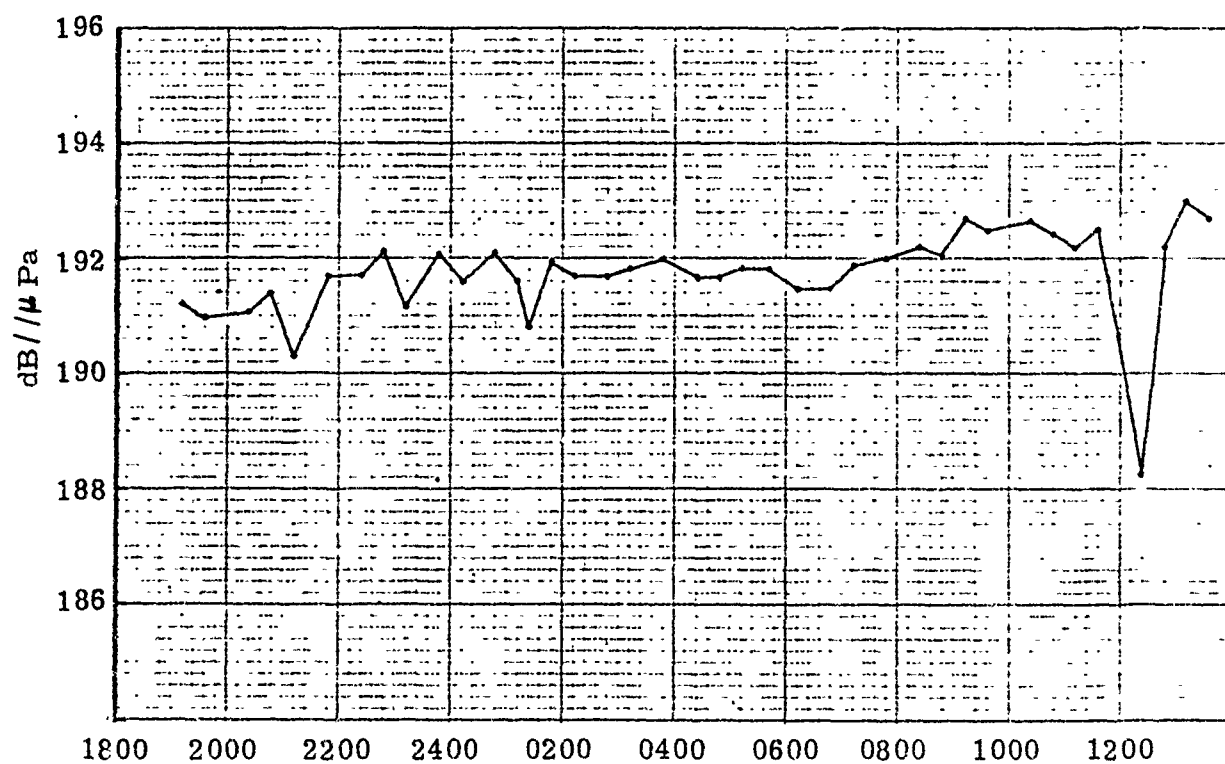
TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
041900 to 041955	100	191	19	A portion of this transmission was down 7 dB due to equipment problems.
042000 to 042055	100	191	19	
042100 to 042155	100	191	19	
042200 to 042355	100	192	19	
050000 to 050055	100	192	19	
050100 to 050155	100	191	19	
050200 to 050255	100	192	19	
050300 to 050355	100	192	19	
050400 to 050455	100	192	19	
050500 to 050555	100	192	19	
050600 to 050655	100	192	19	
050700 to 050755	100	192	19	
050800 to 050855	100	192	19	
050900 to 050955	100	193	19	
051000 to 051055	100	193	19	
051100 to 051155	100	192	19	
051200 to 051255	100	192	19	
051300 to 051355	100	193	19	

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EVENT MS 009
SOUTH ROSE - LEG 2
SHALLOW SOURCE

100 Hz



TIME
GMT 3 & 4 SEPT 1973

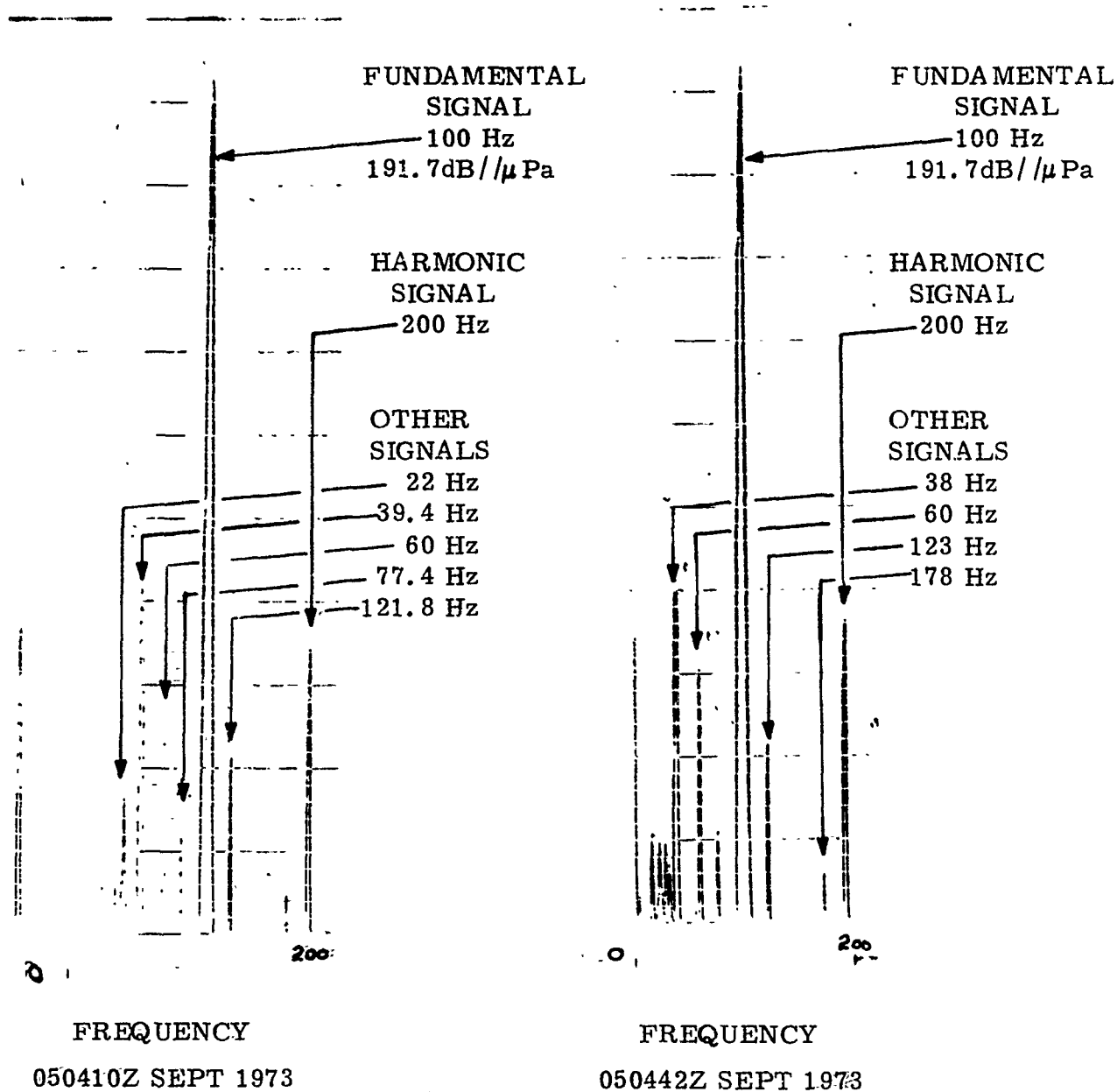
FIGURE 33

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EVENT MS 009
SOUTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 8)

SAMPLE SIGNAL SPECTRUM RECORDING



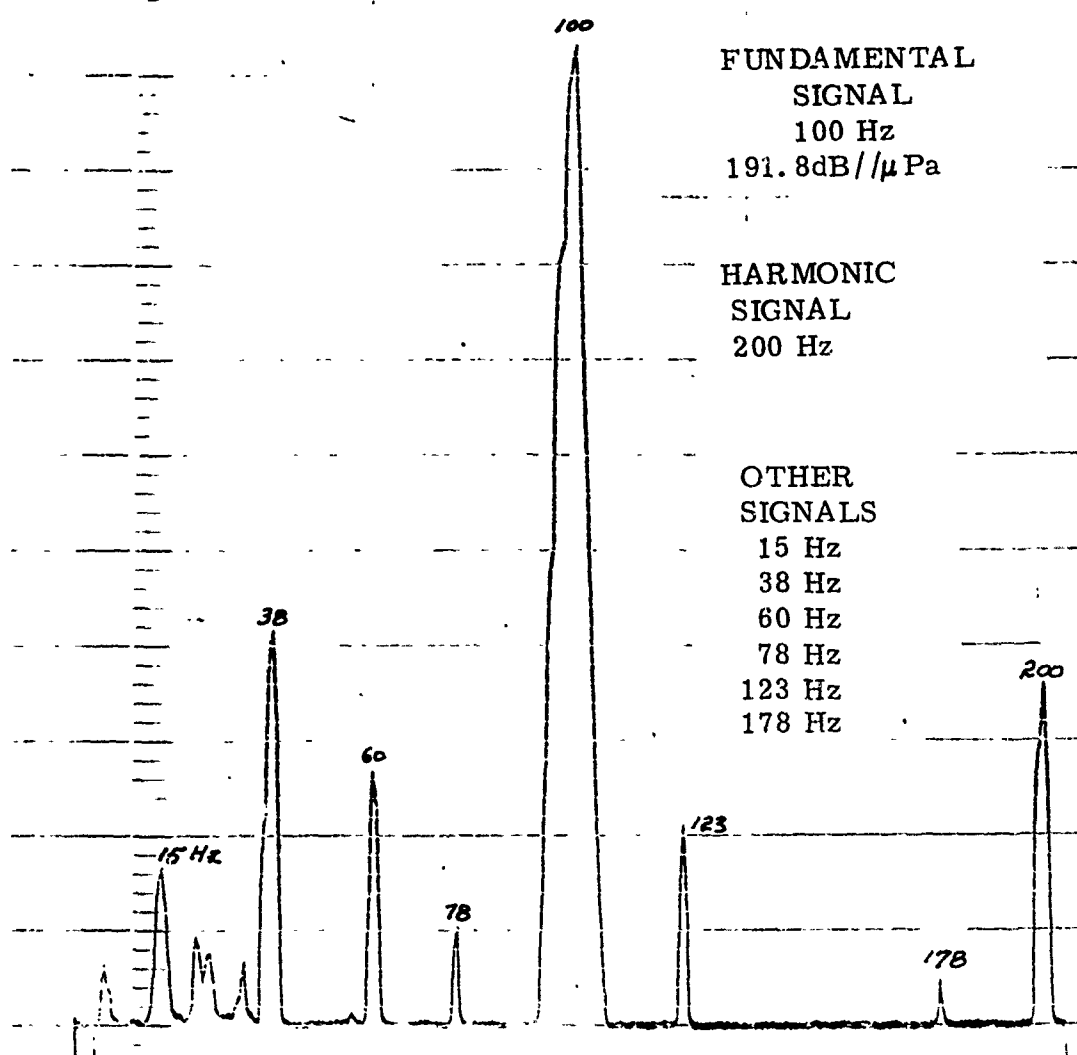
SHALLOW SOURCE

FIGURE 34

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EVENT MS 009
SOUTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 8)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

050506Z SEPT 1973

SHALLOW SOURCE

FIGURE 35

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CONFIDENTIALTABLE 18
EVENT MS 009

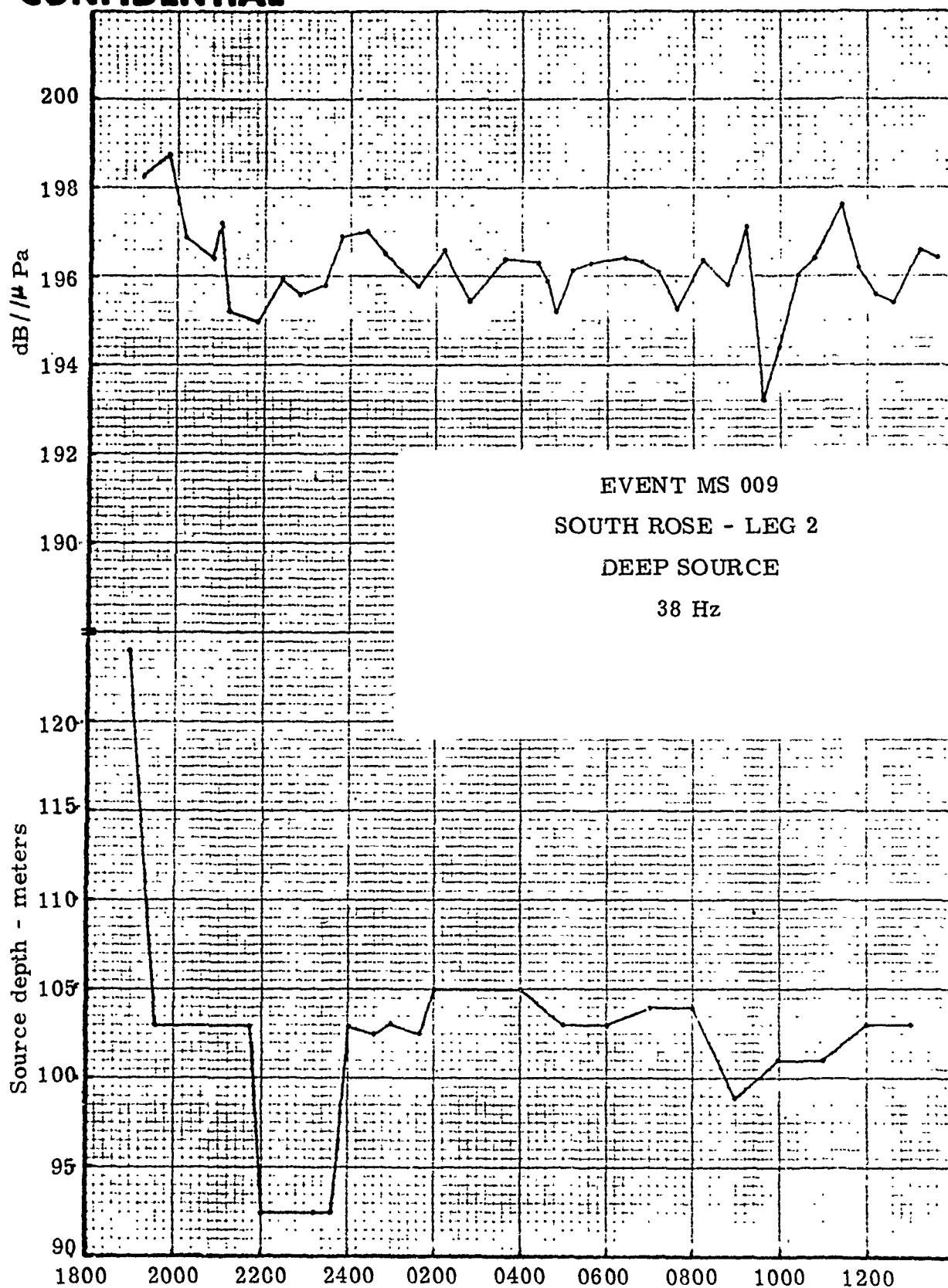
SOUTH ROSE LEG No. 2

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
041900 to 041955	38	199	103	OFF 1945 to 1950.
042000 to 042055	38	197	103	
042100 to 042155	38	195	103	
042200 to 042255	38	196	92	
042300 to 042355	38	196	92	
050000 to 050055	38	197	103	One minute late OFF.
050100 to 050155	38	196	102	
050200 to 050256	38	196	105	
050300 to 050355	38	196	105	
050400 to 050455	38	196	105	
050500 to 050555	38	196	102	
050600 to 050655	38	196	102	
050700 to 050755	38	196	104	
050800 to 050855	38	196	104	
050900 to 050955	38	195	99	
051000 to 051055	38	196	101	
051100 to 051155	38	197	101	
051200 to 051255	38	196	103	
051300 to 051355	38	197	115	

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TIME
GMT 4 & 5 SEPT 1973

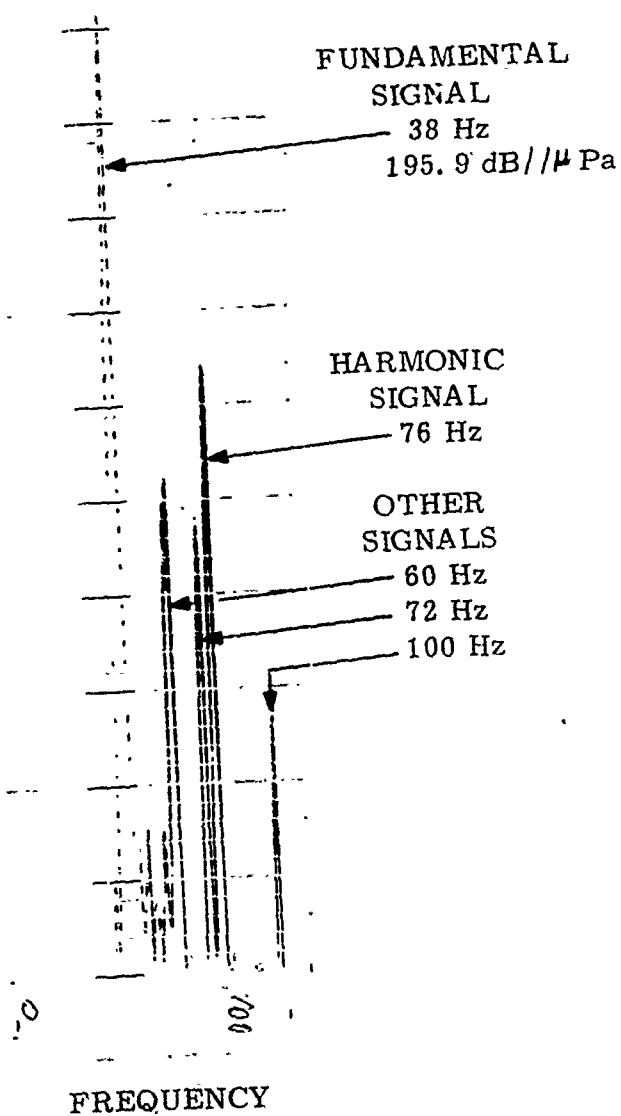
FIGURE 36

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EVENT MS 009
SOUTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 8)
SAMPLE SIGNAL SPECTRUM RECORDING



050435Z SEPT 1973

DEEP SOURCE

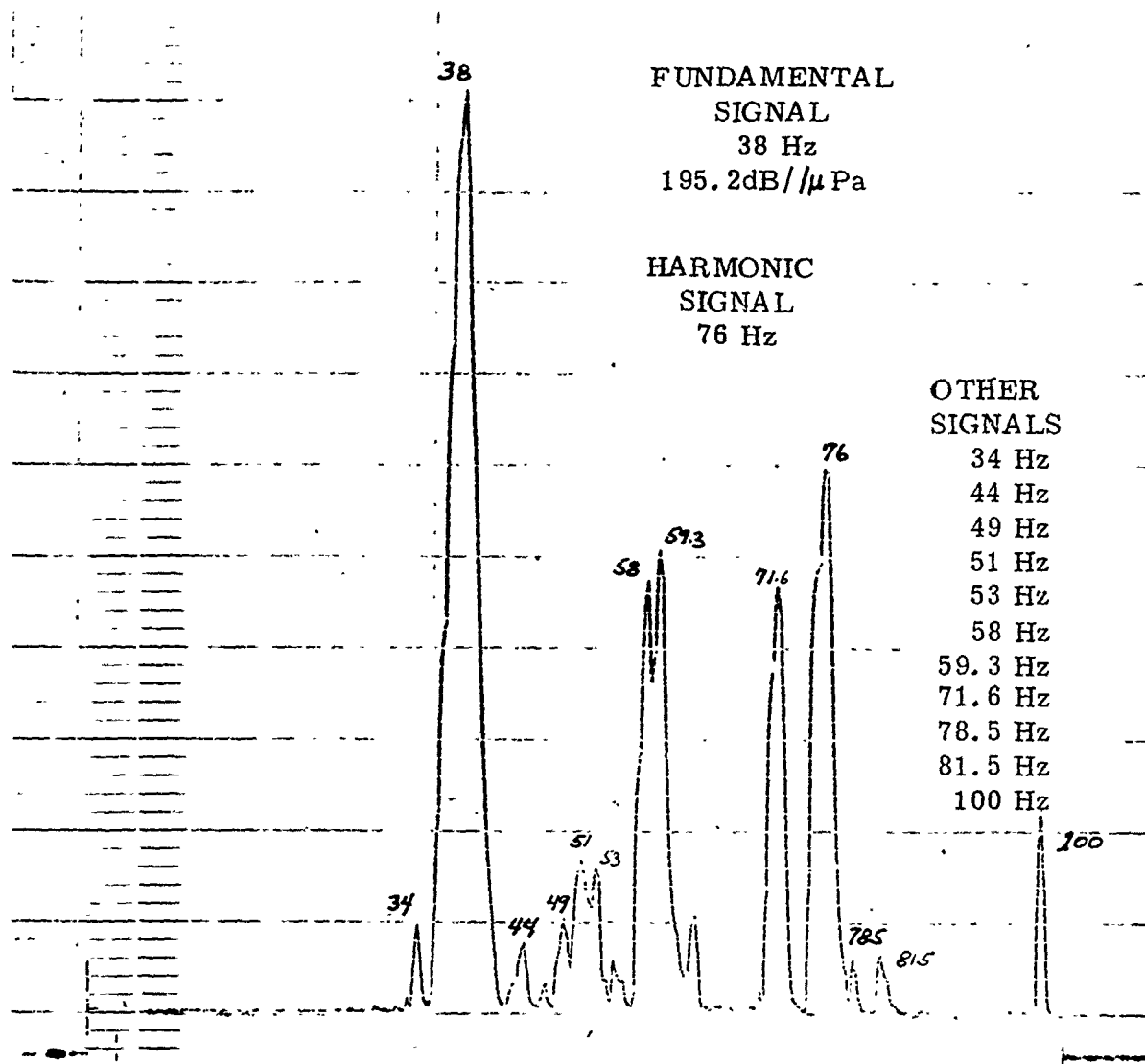
FIGURE 37

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EVENT MS 009
SOUTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 8)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
050455Z SEPT 1973
DEEP SOURCE
FIGURE 38

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TABLE 19

EVENT MS 009

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
041900	F	36° 14. 6'	144° 14. 1'
042000	DR	36° 13. 5'	144° 12. 6'
042130	F	36° 12. 5'	144° 04. 9'
042144	F	36° 12. 3'	144° 02. 8'
042230	DR	36° 12. 0'	144° 00. 0'
042330	DR	36° 11. 0'	143° 53. 1'
050030	F	36° 10. 2'	143° 48. 0'
050130	F	36° 09. 7'	143° 42. 9'
050200	DR	36° 09. 6'	143° 40. 6'
050300	DR	36° 10. 2	143° 35. 2'
050400	F	36° 08. 8'	143° 31. 0'
050500	DR	36° 08. 6'	143° 24. 6'
050533	F	36° 08. 3'	143° 22. 7'
050650	F	36° 08. 2'	143° 16. 9'
050724	F	36° 08. 2'	143° 13. 9'
050906	F	36° 08. 0'	143° 05. 1'
050956	F	36° 07. 8'	143° 00. 5'
051142	F	36° 07. 2'	142° 51. 1'
051252	F	36° 06. 5'	142° 44. 9'
051312	F	36° 06. 0'	142° 43. 6'
051355	DR	36° 05. 6'	142° 40. 6'

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EVENT MS 013

SOUTH ROSE - LEG 4

(Data Analysis Plan Experiment Number 9)

Schedule

Shallow Source

062000Z Sept to 062215Z Sept (Starboard)

062215Z Sept to 071555Z Sept (Port)

29 Hz, 55 minutes ON/5 minutes OFF

at constant source level, starting on the hour

Deep Source

070100Z Sept to 071555Z Sept

38 Hz, 55 minutes ON/5 minutes OFF

at constant source level, starting on the hour

Summary

The steadiness of the source level during this run was not good. The shallow source had a mean source level of 190 dB/ μ Pa and numerous excursions in the + 4 dB range. The spectrum readings indicated the shallow source was having problems. The deep source had a mean source level of 195 dB/ μ Pa and a couple excursions in the -4 dB range.

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TABLE 20
EVENT MS 013
SOUTH ROSE LEG 4

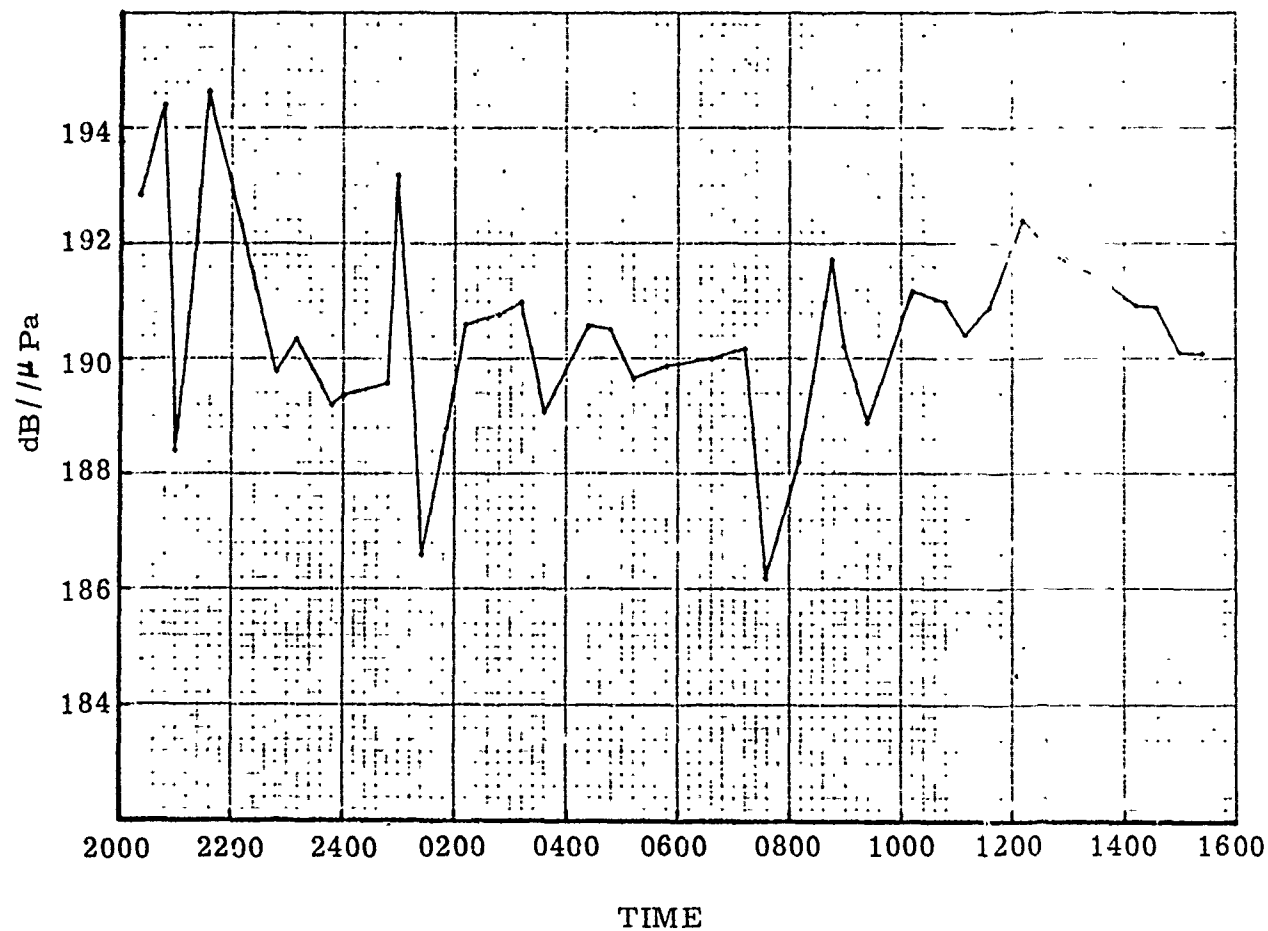
SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
062000 to 062055	29	193	19	Power fluctuations in signal due to vibrator problems
062100 to 062155	29	192	19	
062200 to 062206	29	188	19	
062215 to 062255	29	195	19	
062300 to 062355	29	190	19	
070000 to 070055	29	139	19	
070100 to 070155	29	190	19	
070200 to 070255	29	191	19	
070300 to 070355	29	190	19	
070400 to 070455	29	191	19	
070500 to 070555	29	190	19	
070600 to 070655	29	190	19	
070700 to 070755	29	188	19	
070800 to 070855	29	190	19	
070900 to 070955	29	190	19	
071000 to 071055	29	191	19	
071100 to 071155	29	191	19	
071200 to 071255	29	192	19	
071300 to 071355	29	192	19	
071400 to 071455	29	191	19	
071500 to 071555	29	190	19	

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EVENT MS 013
SOUTH ROSE - LEG 4
SHALLOW SOURCE
29 Hz



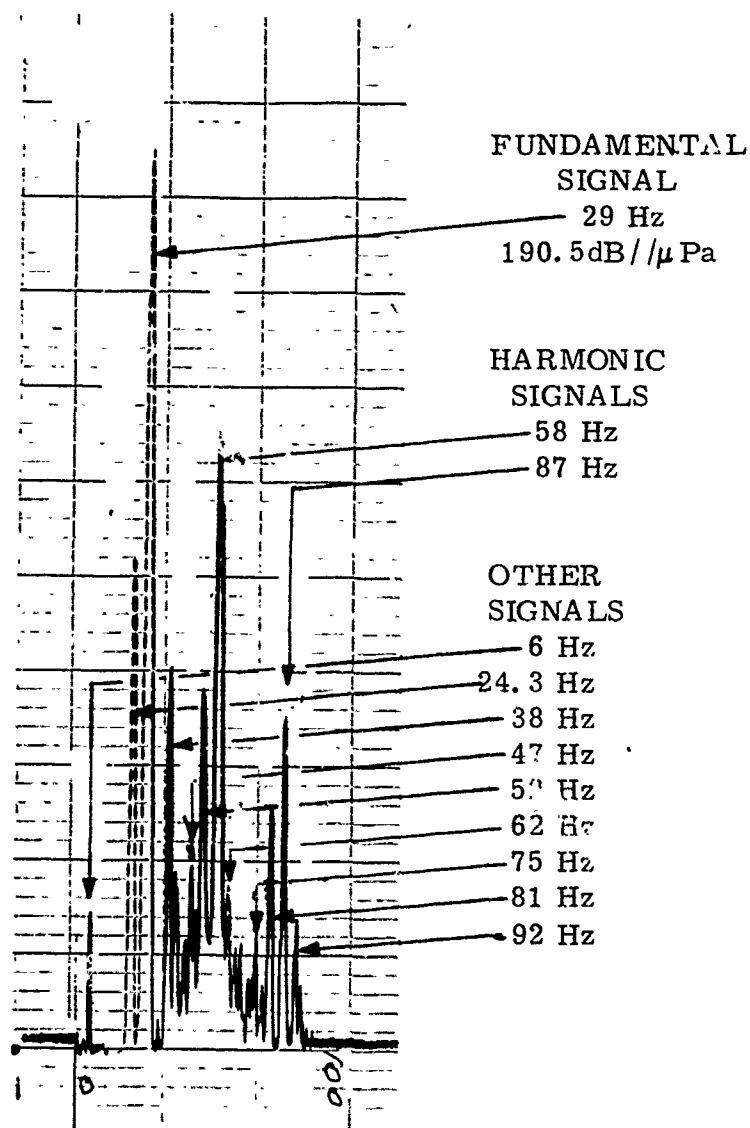
TIME
GMT 6 & 7 SEPT 1973

FIGURE 39

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EVENT MS 013
SOUTH ROSE - LEG 4
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 9)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

070448Z SEPT 1973

SHALLOW SOURCE

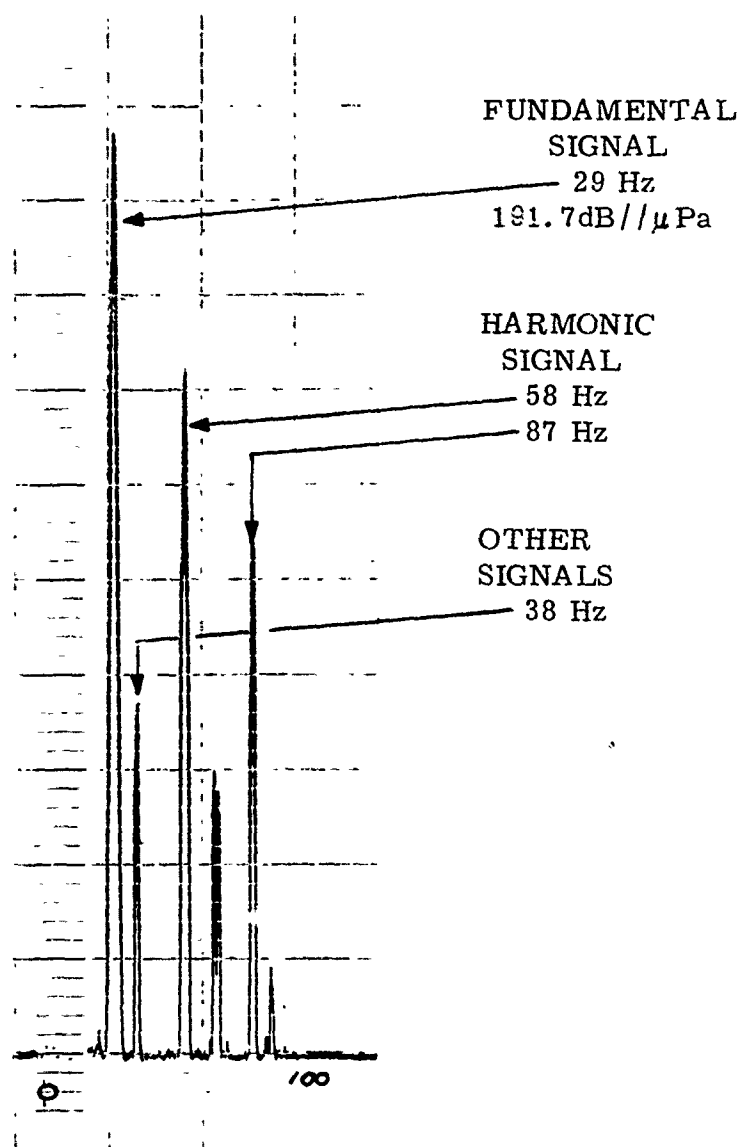
FIGURE 40

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EVENT MS 013
SOUTH ROSE - LEG 4
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 9)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
070834Z SEPT 1973
SHALLOW SOURCE
FIGURE 41
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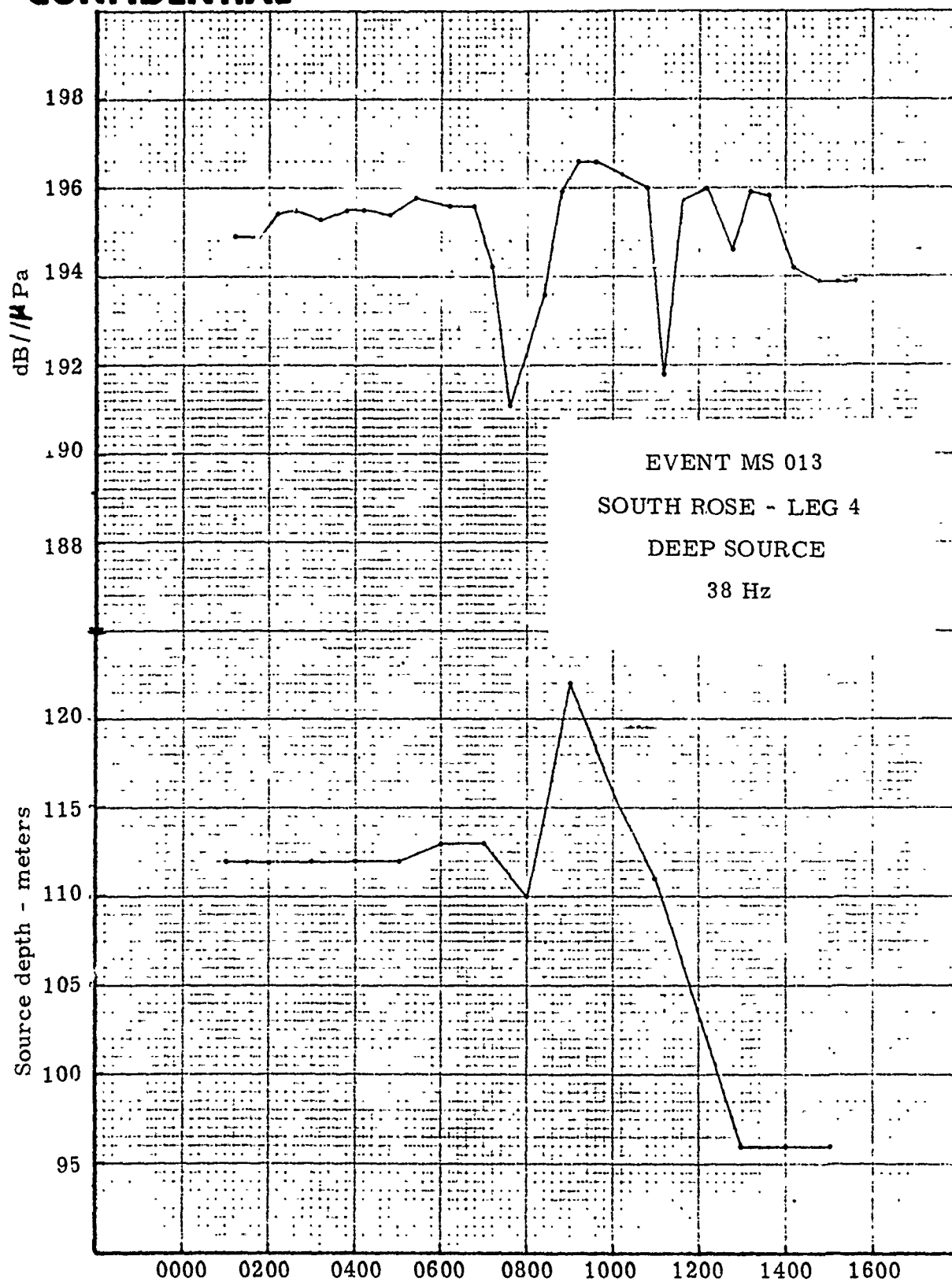
TABLE 21
EVENT MS 013
SOUTH ROSE LEG 4

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
070100 to 070155	38	195	112	Five hours late in starting transmission
070200 to 070255	38	195	112	
070300 to 070355	38	195	112	
070400 to 070455	38	195	112	
070500 to 070555	38	196	112	
070600 to 070655	38	196	113	
070700 to 070755	38	193	113	
070800 to 070855	38	195	110	
070900 to 070955	38	196	122	
071000 to 071055	38	196	116	
071100 to 071155	38	194	111	
071200 to 071255	38	195	96	
071300 to 071303	38	196	96	
071307 to 071325	38	196	96	
071330 to 071355	38	196	96	
071400 to 071420	38	194	96	
071426 to 071455	38	194	96	
071500 to 071555	38	194	96	

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TIME
GMT 7 SEPT 1973

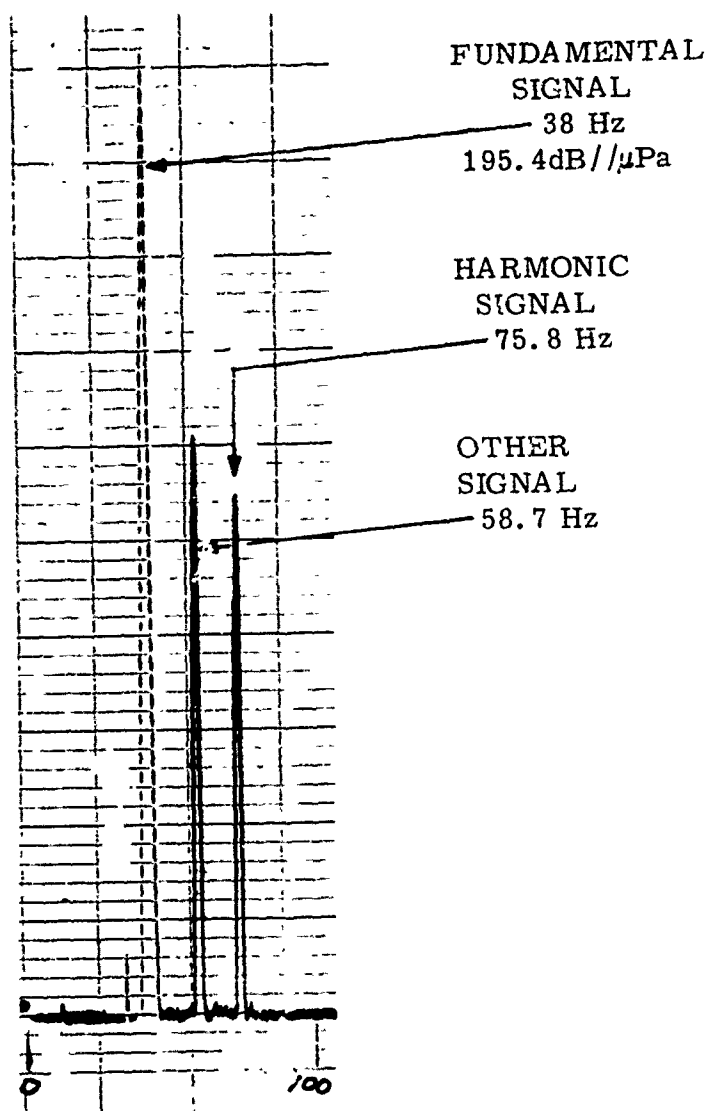
FIGURE 42

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EVENT MS 013
SOUTH ROSE - LEG 4
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 9)



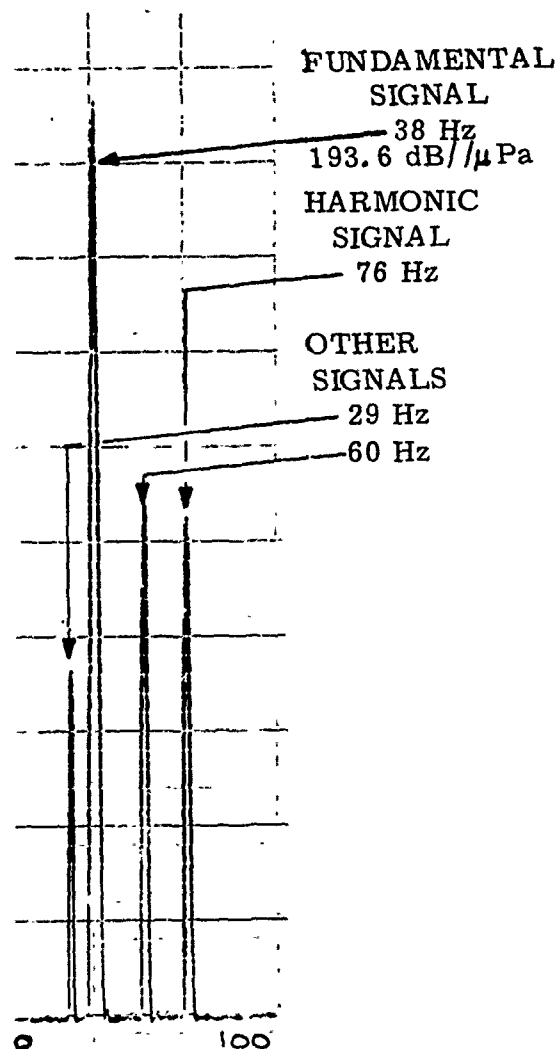
FREQUENCY
070438Z SEPT 1973
DEEP SOURCE

FIGURE 43

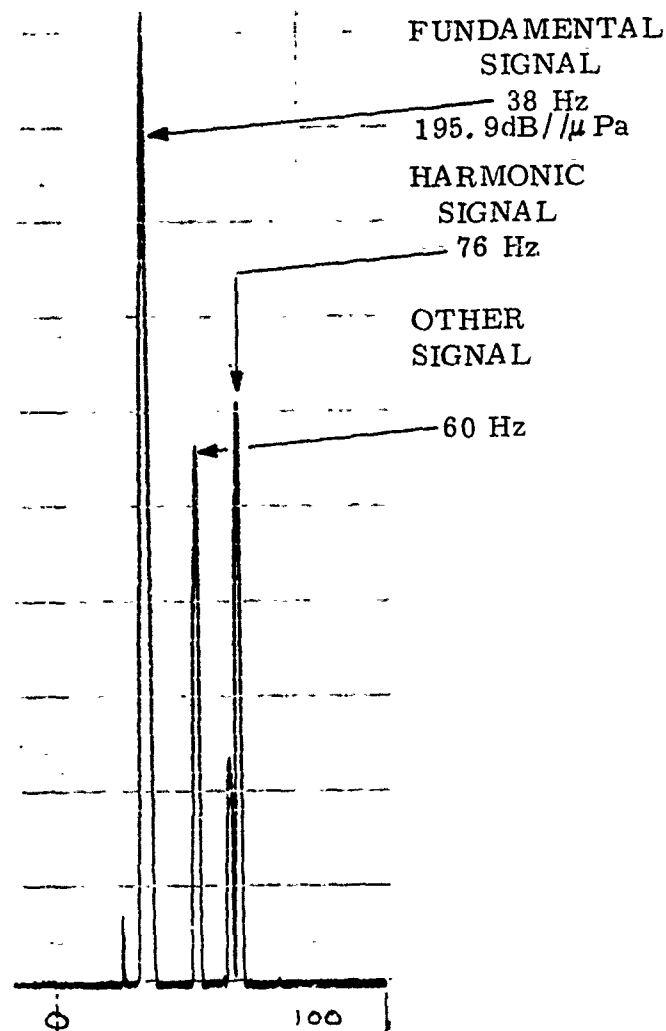
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EVENT MS 013
SOUTH ROSE - LEG 4
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 9)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
070817Z SEPT 1973



FREQUENCY
070837Z SEPT 1973

DEEP SOURCE

FIGURE 44

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TABLE 22

EVENT MS 013

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
062000	DR	36° 43. 9'	143° 58. 7'
062100	DR	36° 42. 2'	143° 57. 7'
062136	F	36° 41. 5'	144° 00. 2'
062152	DR	36° 41. 5'	144° 01. 4'
062200	DR	36° 40. 8'	144° 00. 9'
062215	F	36° 40. 2'	143° 59. 5'
062304	F	36° 35. 3'	143° 53. 5'
070000	F	36° 32. 5'	143° 51. 2'
070030	DR	36° 31. 0'	143° 49. 2'
070132	F	36° 27. 7'	143° 47. 6'
070200	F	36° 25. 1'	143° 46. 4'
070300	F	36° 22. 0'	143° 42. 9'
070340	F	36° 21. 2'	143° 44. 0'
070408	F	36° 18. 8'	143° 41. 3'
070500	DR	36° 15. 3'	143° 36. 0'
070600	DR	36° 11. 1'	143° 33. 2'
070702	F	36° 08. 0'	143° 32. 0'
070800	DR	36° 02. 3'	143° 28. 9'
070900	DR	35° 59. 3'	143° 26. 6'
070952	F	35° 57. 7'	143° 26. 8'
071100	F	35° 54. 5'	143° 22. 6'
071256	F	35° 47. 9'	143° 17. 6'
071400	DR	35° 43. 4'	143° 14. 5'
071500	DR	35° 38. 2'	143° 12. 0'

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EVENT MS 017

SOUTH ROSE - LEG 5

(Data Analysis Plan Experiment Number 10)

Schedule

Shallow Source (Port)

080200Z Sept to 081924Z Sept

38 Hz, 55 minutes ON/5 minutes OFF
at constant source power level starting
on the hour

Deep Source

080200Z Sept to 081924Z Sept

29 Hz, 55 minutes ON/5 minutes OFF
at constant source power level starting
on the hour

Summary

The shallow source transmission power levels averaged 193 dB/ μ Pa for the first five hours of transmission; and then 191 dB/ μ Pa with major power excursions at 0900 hours and 1300 hours. The deep source was more steady than the shallow. The average deep source power level for the first five hours of transmission was 195 dB/ μ Pa. The remaining portion of the transmission averages $194 \pm 1 \frac{1}{2}$ dB/ μ Pa.

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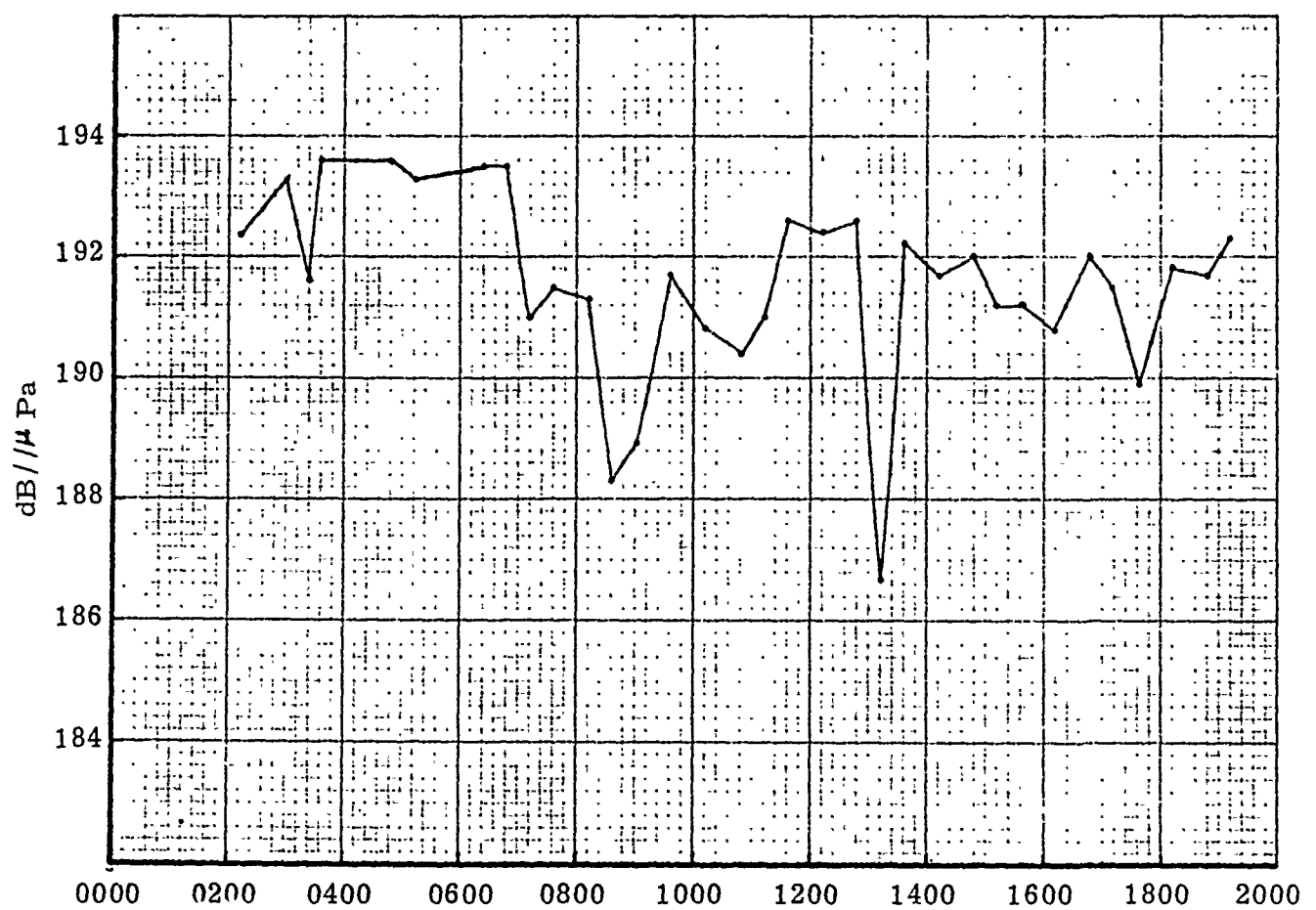
TABLE 23
EVENT MS 017
SOUTH ROSE - LEG 5

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
080200 to 080255	38	193	19	
080300 to 080355	38	193	19	
080400 to 080455	38	194	19	
080500 to 080555	38	193	19	
080600 to 080655	38	194	19	
080700 to 080755	38	191	19	
080800 to 080855	38	190	19	
080900 to 080955	38	190	19	
081000 to 081055	38	191	19	
081100 to 081155	38	192	19	
081200 to 081255	38	193	19	
081300 to 081355	38	189	19	
081400 to 081455	38	192	19	
081500 to 081555	38	191	19	
081600 to 081655	38	192	19	
081700 to 081755	38	190	19	
081800 to 081855	38	192	19	
081900 to 081924	38	192	19	

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EVENT MS 017
SOUTH ROSE - LEG 5
SHALLOW SOURCE
38 Hz



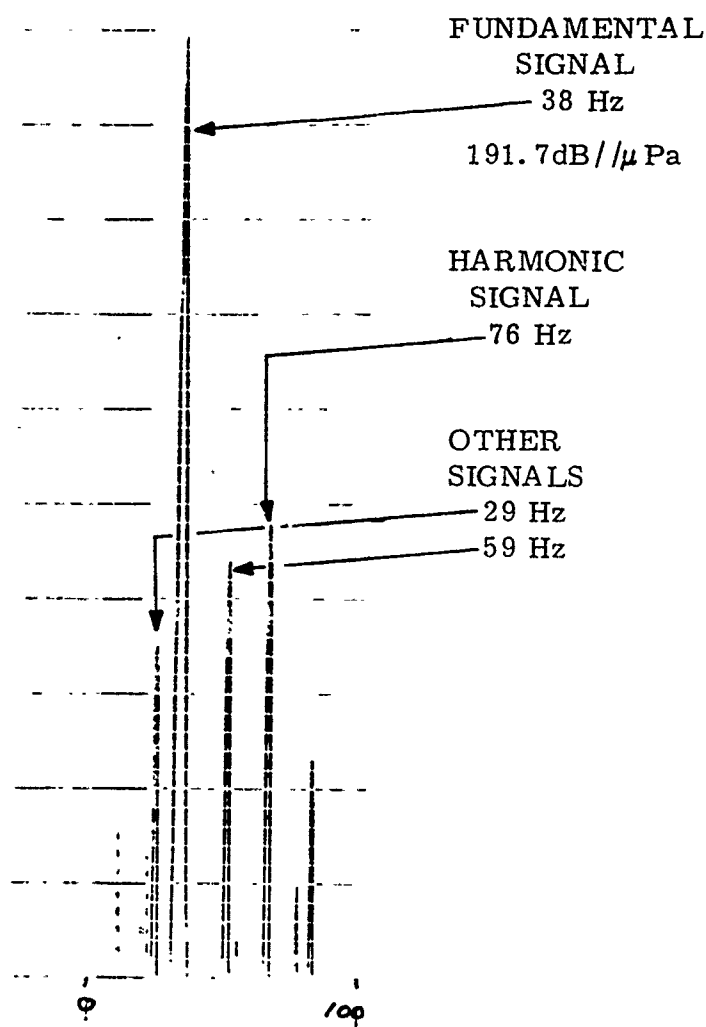
TIME
GMT 8 Sept 1973

FIGURE 45

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EVENT MS 017
SOUTH ROSE - LEG 5
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 10)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
081403Z SEPT 1973
SHALLOW SOURCE

FIGURE 46

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TABLE 24
EVENT MS 017
SOUTH ROSE LEG 5

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
080200 to 080255	29	197	111	Hydraulic problems
080300 to 080355	29	195	100	
080400 to 080455	29	195	100	
080500 to 080555	29	196	101	
080600 to 080648	29	195	101	
080650 to 080655	29	195	101	Hydraulic problems
080700 to 080728	29	195	103	
080733 to 080755	29	195	103	Two min late
080802 to 080855	29	193	103	
080901 to 080955	29	195	103	One min late
081000 to 081055	29	193	99	
081100 to 081155	29	194	99	OFF early - hydraulic problems
081200 to 081255	29	194	99	
081300 to 081355	29	194	96	
081400 to 081455	29	194	101	
081500 to 081555	29	195	103	
081600 to 081653	29	195	104	End of 80 nm leg
081700 to 081755	29	195	104	
081800 to 081855	29	194	104	
081900 to 081924	29	195	104	

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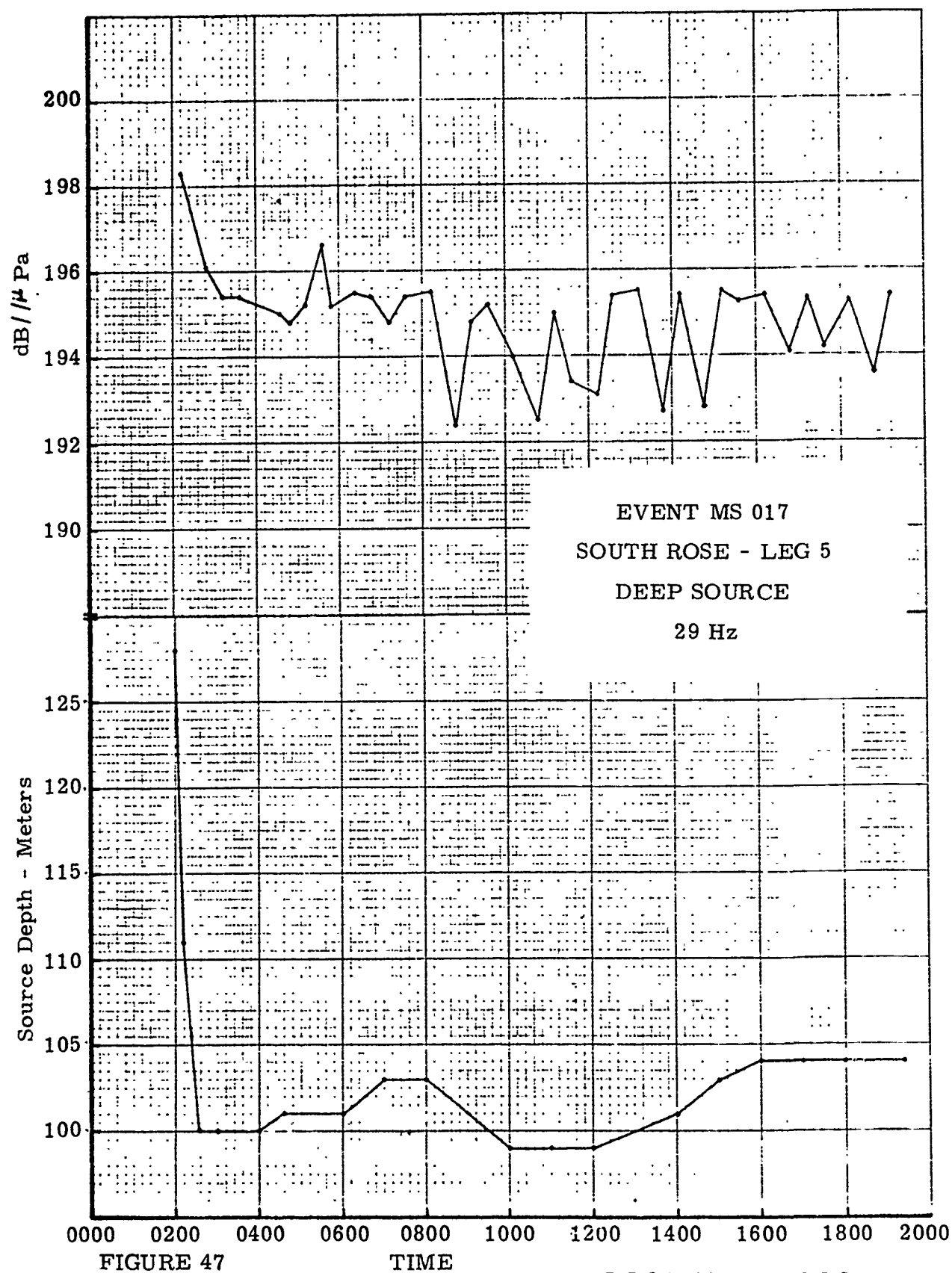


FIGURE 47

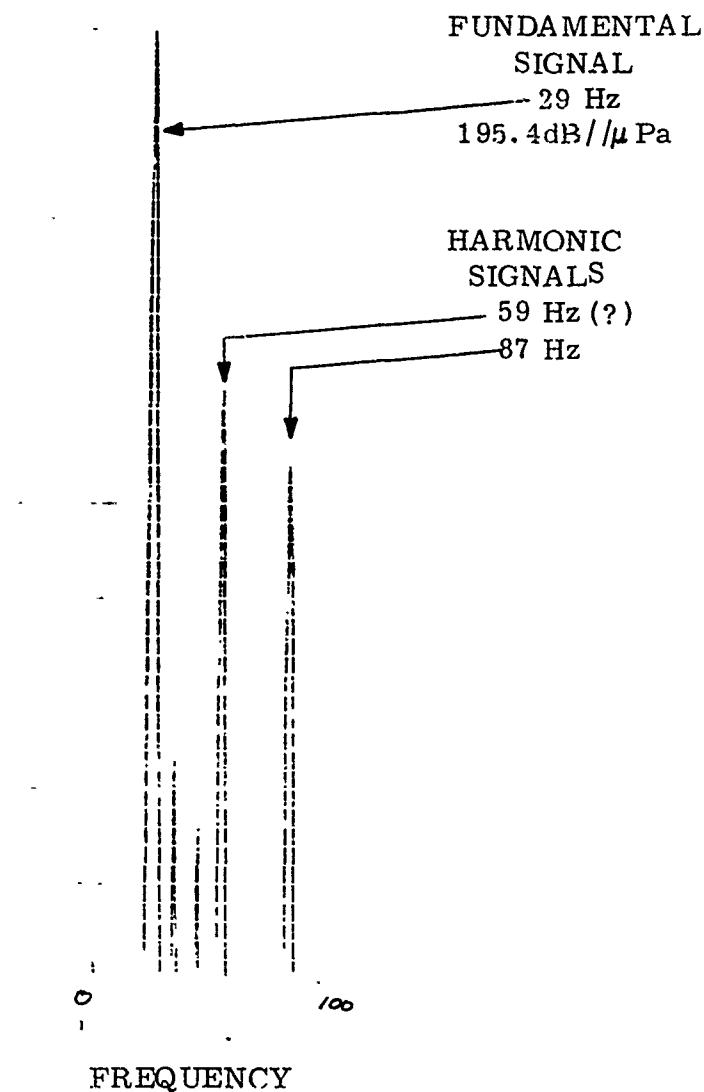
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GMT 8 Sept 1973

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EVENT MS 017
SOUTH ROSE - LEG 5
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 10)
SAMPLE SIGNAL SPECTRUM RECORDING



081407Z SEPT 1973

DEEP SOURCE

FIGURE 48

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TABLE 25

EVENT MS 017

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
080200	DR	35° 35. 3'	143° 54. 2'
080300	F	35° 37. 6'	143° 50. 5'
080400	DR	35° 41. 0'	143° 46. 8'
080505	F	35° 46. 1'	143° 44. 6'
080630	F	35° 52. 0'	143° 41. 3'
080800	DR	35° 57. 5'	143° 37. 6'
080900	F	36° 02. 9'	143° 36. 6'
081012	F	36° 08. 0'	143° 32. 5'
081228	F	36° 16. 6'	143° 24. 8'
081412	F	36° 27. 9'	143° 14. 1'
081536	F	36° 27. 9'	143° 15. 4'
081700	DR	36° 35. 2'	143° 12. 2'
081800	DR	36° 39. 4'	143° 10. 3'
081900	DR	36° 43. 6'	143° 07. 3'
081924	F	36° 44. 2'	143° 06. 8'

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EVENT MS 021

NORTH ROSE - LEG 1

(Data Analysis Plan Experiment Number 13)

Schedule

Shallow Source

092200Z Sept to 100415Z Sept (Port)
100415Z Sept to 101723Z Sept (Starboard)
29 Hz, 8 minutes ON/7 minutes OFF
at a constant power level starting
on the quarter hour

Deep Source

092200Z Sept to 100902Z Sept
11, 23, 33, 100 Hz, 8 minutes ON/7 minutes
OFF each frequency; at a constant power level,
repeat every hour

Summary

Shallow source was erratic during the first one and a half hours of transmission, then started to transmit at a constantly increasing source level. The average source level was 178 ± 1 dB// μ Pa at 2330 hours, then gradually increased to 182 ± 1 dB// μ Pa at 1000 hours and remained constant thereafter. The deep source was so erratic that the complete transmission is of questionable value.

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TABLE 26

EVENT MS 021

NORTH ROSE LEG 1

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
092200 to 092208	29	174	18	Malfunction in port vibrator, switch to starboard unit
092215 to 092223	29	174	18	
092230 to 092238	29	175	18	
092245 to 092253	29	175	18	
092300 to 092308	29	174	18	
092315 to 092323	29	179	18	
092330 to 092338	29	178	18	
092345 to 092356	29	178	18	
100000 to 100008	29	178	18	
100015 to 100023	29	177	18	
100030 to 100038	29	179	18	
100045 to 100053	29	179	19	
100100 to 100108	29		20	
100115 to 100123	29	179	20	
100130 to 100138	29	178	20	
100145 to 100153	29	179	20	
100200 to 100208	29	179	20	
100215 to 100223	29	179	20	
100230 to 100238	29	179	20	
100245 to 100253	29	180	20	
100300 to 100308	29	180	20	
100315 to 100323	29	179	20	
100330 to 100338	29	180	20	
100345 to 100353	29	178	20	
100400 to 100408	29	181	19	
100415 to 100423	29	181	19	
100430 to 100438	29	181	19	
100445 to 100453	29	180	19	
100500 to 100508	29	181	21	
100515 to 100523	29	180	21	
100530 to 100538	29	180	21	
100545 to 100553	29	180	21	
100600 to 100608	29	180	21	
100615 to 100623	29	181	21	
100630 to 100638	29	180	21	
100645 to 100653	29	179	21	
100700 to 100708	29	180	21	
100715 to 100723	29	180	20	
100730 to 100738	29	183	20	

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TABLE 26 (Continued)

EVENT MS 021

NORTH ROSE LEG 1

SHALLOW SOURCE (Continued)

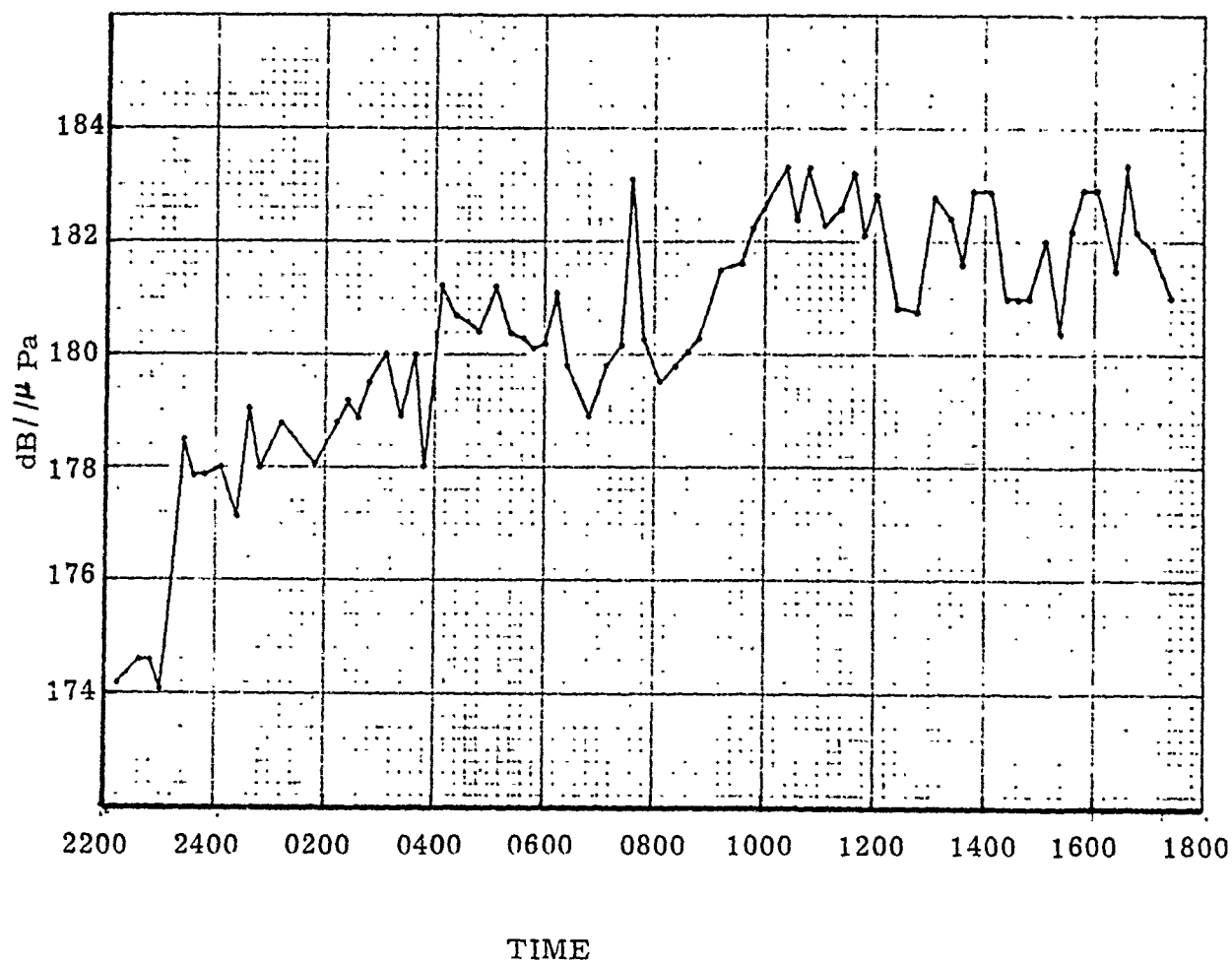
TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
100745 to 100753	29		20	
100800 to 100808	29	180	20	
100815 to 100823	29	180	20	
100830 to 100838	29	180	20	
100845 to 100853	29	180	20	
100900 to 100908	29		20	
100915 to 100923	29	182	20	
100930 to 100938	29	182	20	
100945 to 100953	29	182	20	
101000 to 101008	29	183	20	
101015 to 101023	29	183	20	
101030 to 101038	29	182	20	
101045 to 101053	29	183	20	
101100 to 101108	29	182	20	
101115 to 101123	29	183	20	
101130 to 101138	29	183	20	
101145 to 101153	29	182	20	
101200 to 101208	29	183	20	
101215 to 101223	29	181	20	
101230 to 101238	29		20	
101245 to 101253	29	181	20	
101300 to 101308	29	183	20	
101315 to 101323	29	182	20	
101330 to 101338	29	182	20	
101345 to 101353	29	183	20	
101400 to 101408	29	183	20	
101415 to 101423	29	181	20	
101430 to 101438	29	181	20	
101445 to 101453	29	181	20	
101500 to 101508	29	182	20	
101515 to 101523	29	180	20	
101530 to 101538	29	182	20	
101545 to 101553	29	183	20	
101600 to 101608	29	183	20	
101615 to 101623	29	182	20	
101630 to 101638	29	183	20	
101645 to 101653	29	182	20	
101700 to 101708	29	182	20	
101715 to 101723	29	181	20	

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EVENT MS 021
NORTH ROSE - LEG 1
SHALLOW SOURCE

29 Hz



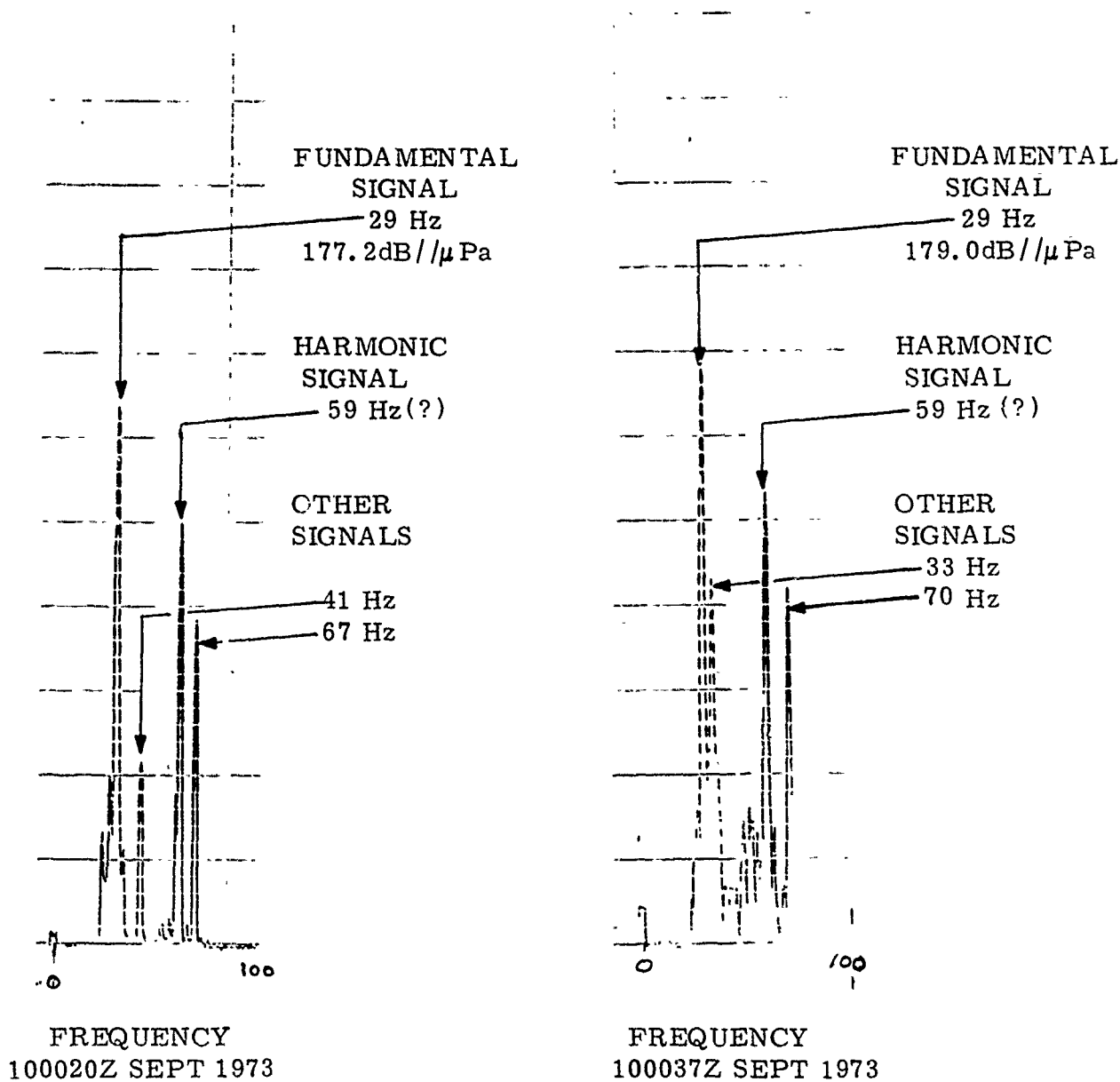
TIME
GMT 9 & 10 Sept 1973

FIGURE 49

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



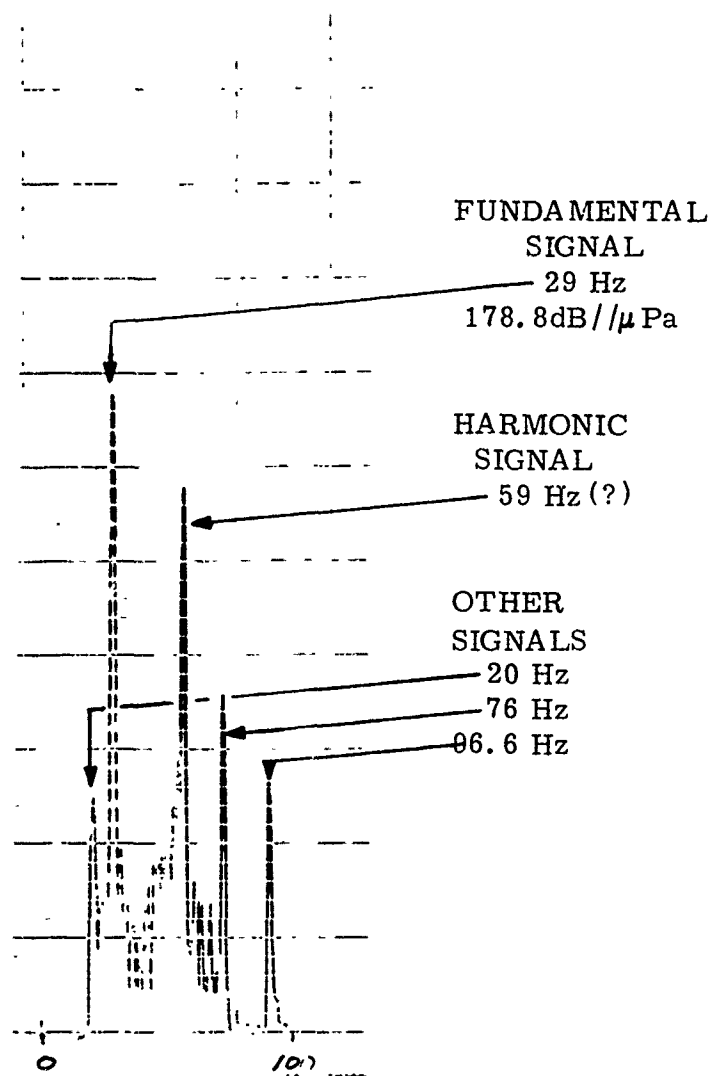
SHALLOW SOURCE

FIGURE 50

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

100053Z SEPT 1973

SHALLOW SOURCE

FIGURE 51

CONFIDENTIAL

TABLE 27

EVENT MS 021

NORTH ROSE LEG 1

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
092200 to 092208	11	184	103	Three minutes late on OFF
092215 to 092223	23	179	103	
092230 to 092238	38	180	103	
092245 to 092253	100	183	103	
092300 to 092308	11	186	103	
092315 to 092323	23	181	103	
092330 to 092338	38	182	103	
092345 to 092356	100	181	103	
100000 to 100008	11	187	103	
100015 to 100023	23	184	103	
100030 to 100038	38	182	103	
100045 to 100053	100	181	103	
100100 to 100108	11	187	91	
100115 to 100123	23	181	94	
100130 to 100138	38		94	
100145 to 100153	100	183	94	
100200 to 100208	11	188	94	
100215 to 100223	23	176	94	
100230 to 100238	38	185	94	
100245 to 100253	100	178	94	
100300 to 100308	11	190	94	
100315 to 100323	23	189	94	
100330 to 100338	38	184	94	
100345 to 100353	100	180	94	
100400 to 100408	11	192	94	
100415 to 100423	23	189	91	
100430 to 100438	38	185	99	
100445 to 100453	100	184	99	
100500 to 100508	11	192	107	
100515 to 100523	23	184	107	
100530 to 100538	38	181	114	
100545 to 100553	100	182	122	
100600 to 100608	11	188	122	
100615 to 100623	23	176	122	
100630 to 100638	38	177	122	
100645 to 100653	100	182	127	
100700 to 100708	11	183	127	
100715 to 100723	23	183	125	
100730 to 100738	38	183	125	

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TABLE 27 (Continued)

EVENT MS 021

NORTH ROSE LEG 1

DEEP SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
100745 to 100753	100	184	123	No output from source
100800 to 100808	11	185	123	
100815 to 100823	23		123	
100830 to 100838	38		123	
100845 to 100853	100	185	123	
100900 to 100902	11		123	

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EVENT MS 021
NORTH ROSE - LEG 1
DEEP SOURCE
11, 23, 38, 100, Hz

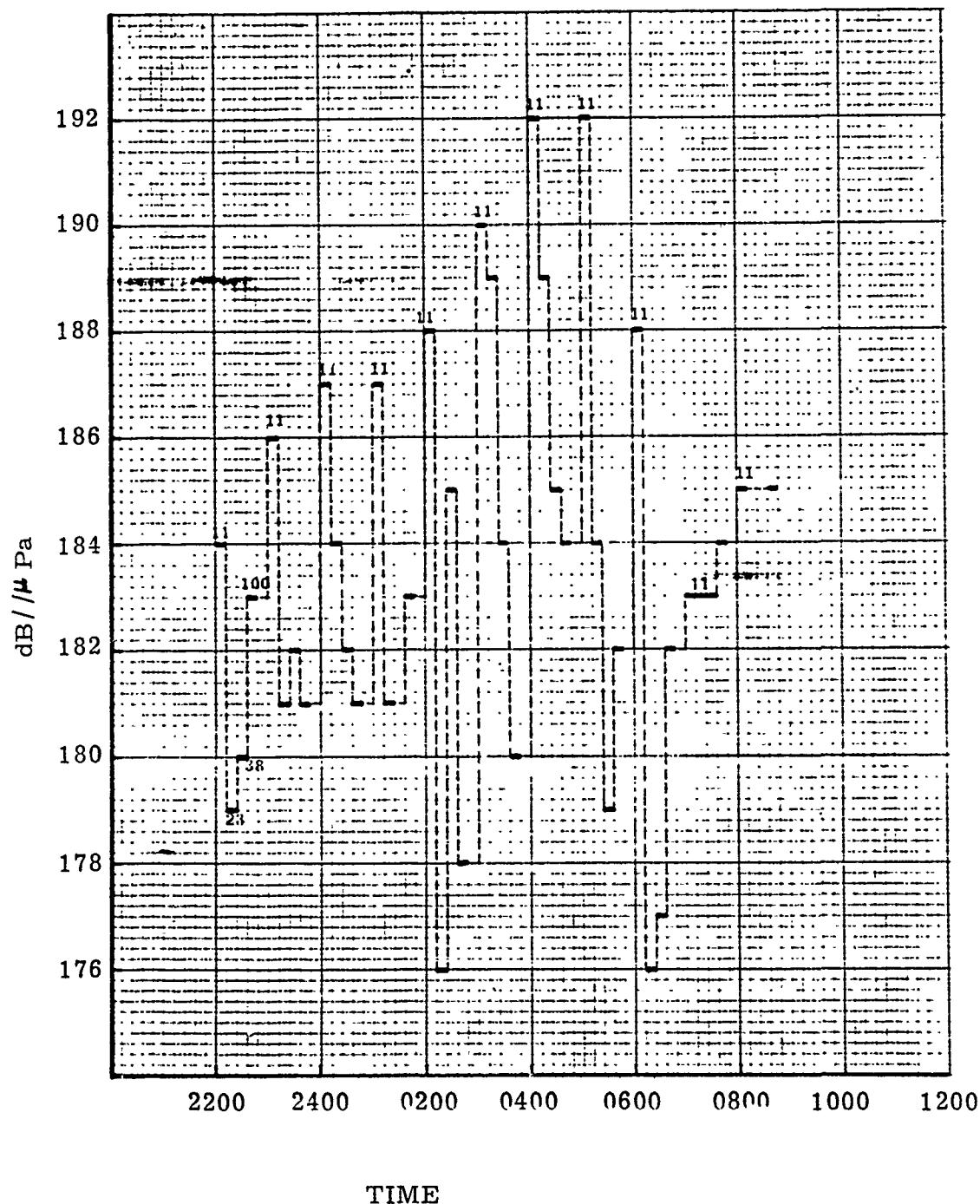


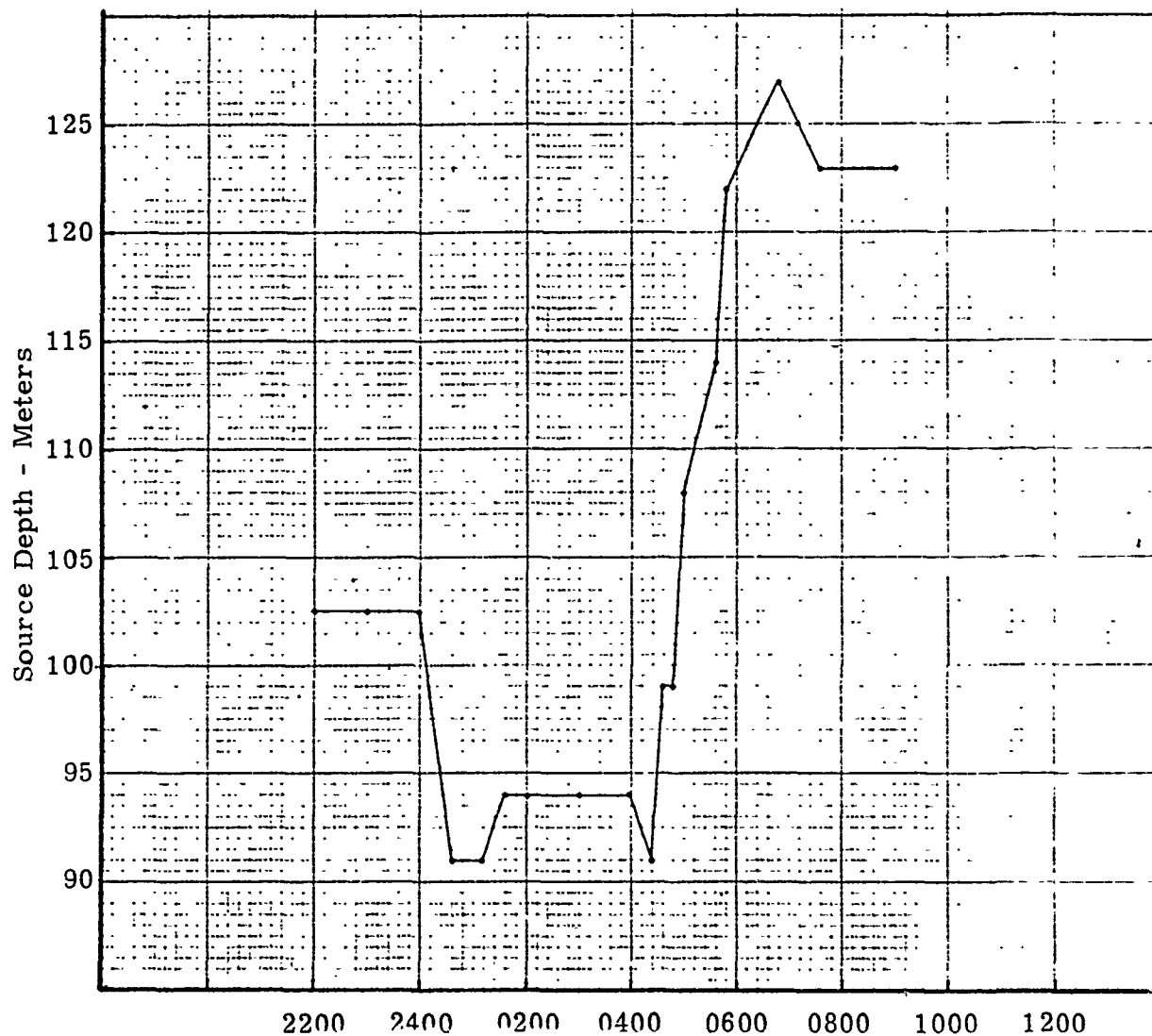
FIGURE 52

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EVENT MS 021
NORTH ROSE - LEG 1
DEEP SOURCE



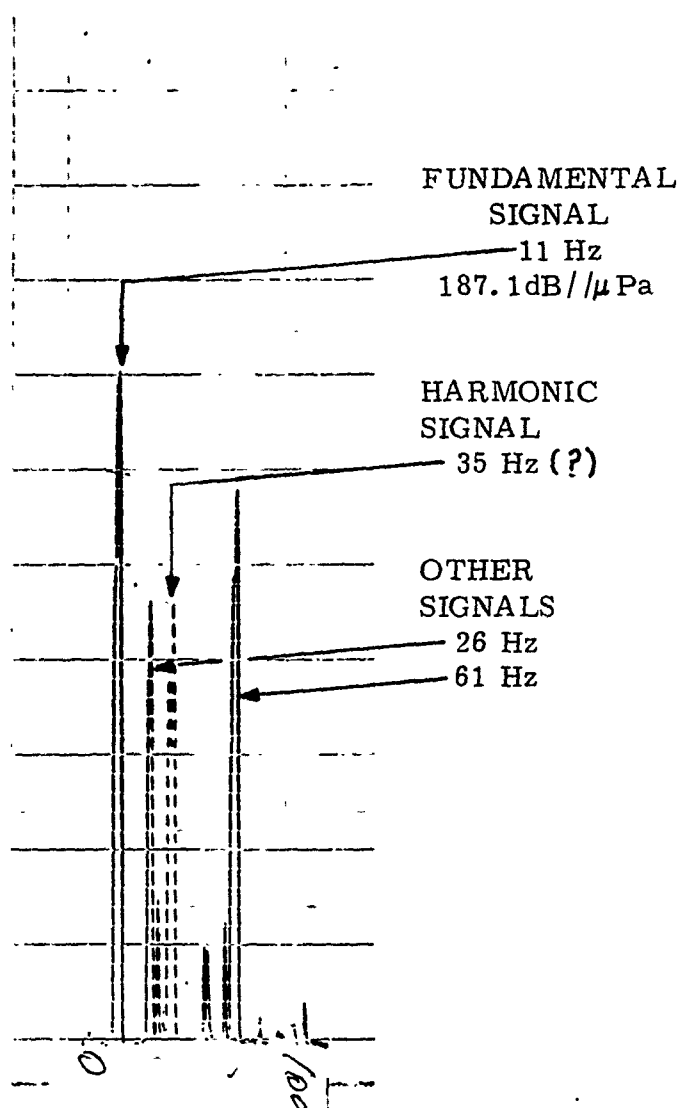
TIME
GMT 9 & 10 Sept 1973

FIGURE 53

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

100102Z SEPT 1973

DEEP SOURCE

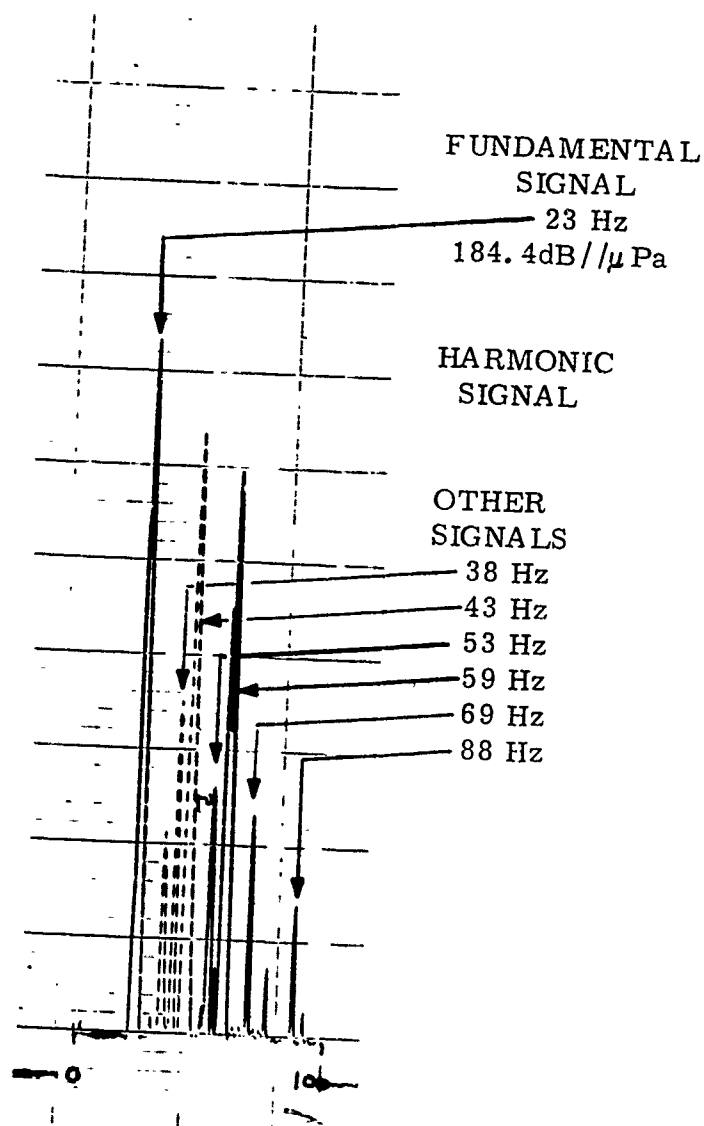
FIGURE 54

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

100017Z SEPT 1973

DEEP SOURCE

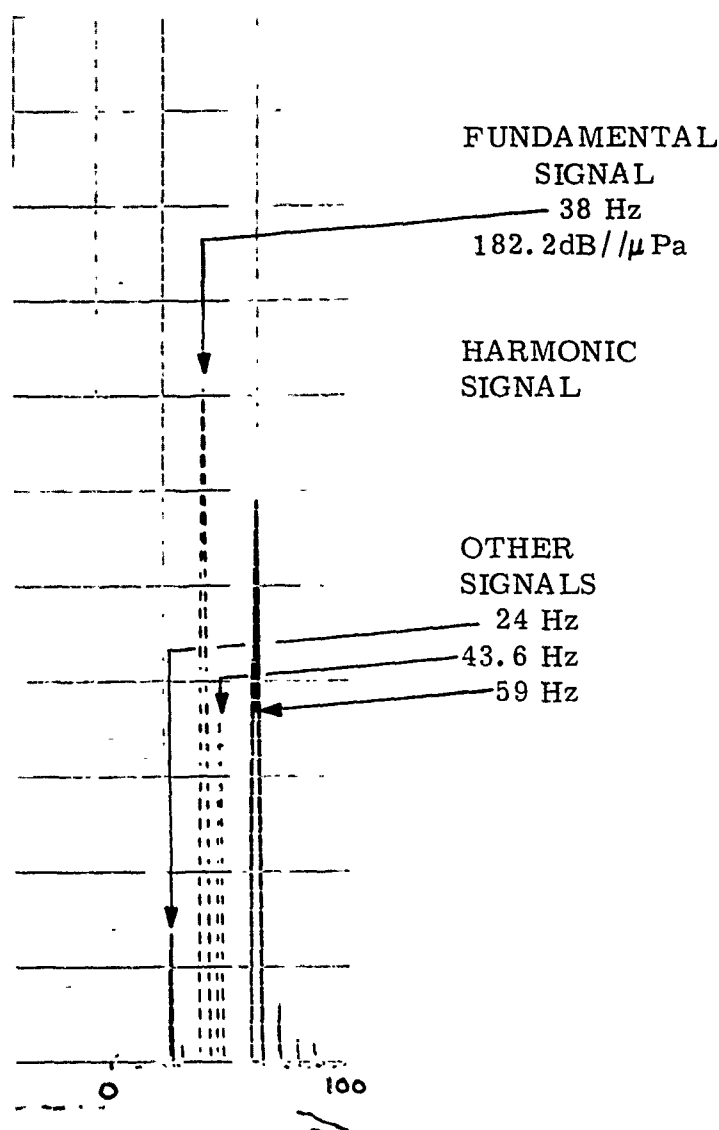
FIGURE 55

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



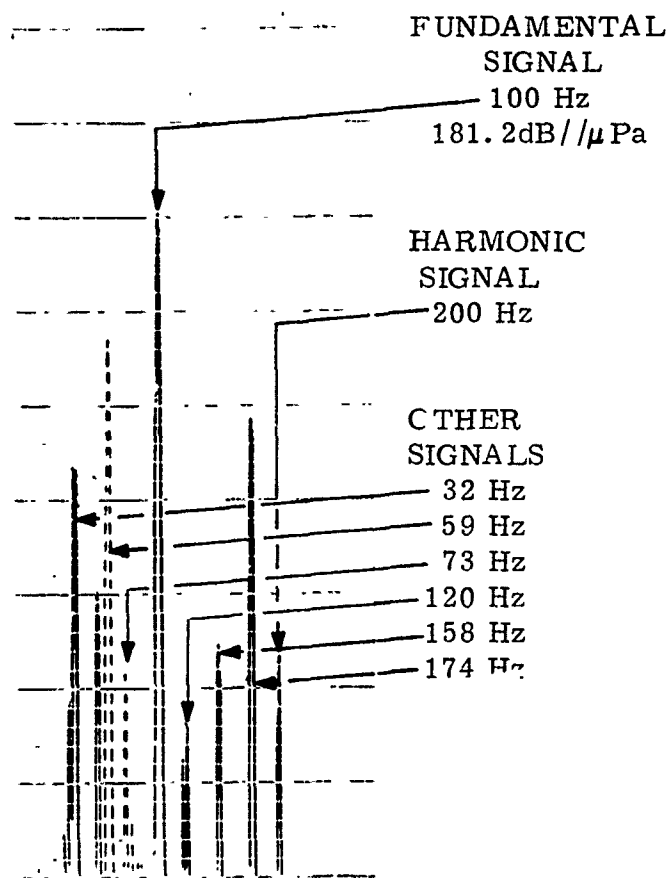
FREQUENCY
100032Z SEPT 1973
DEEP SOURCE

FIGURE 56

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EVENT MS 021
NORTH ROSE - LEG 1
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 13)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY

100047Z SEPT 1973

DEEP SOURCE

FIGURE 57

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TABLE 28
EVENT MS 021
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
092200	DR	38° 37. 9'	143° 46. 2'
092300	F	38° 41. 6'	143° 44. 5'
100001	DR	38° 46. 4'	143° 42. 0'
100100	F	38° 52. 7'	143° 40. 0'
100200	DR	38° 56. 7'	143° 37. 0'
100300	F	39° 02. 6'	143° 35. 3'
100345	F	39° 05. 5'	143° 33. 1'
100430	DR	39° 08. 2'	143° 31. 7'
100500	F	39° 11. 1'	143° 31. 4'
100600	DR	39° 14. 7'	143° 28. 3'
100645	F	39° 16. 8'	143° 26. 8'
100730	DR	39° 19. 4'	143° 25. 8'
100800	DR	39° 20. 4'	143° 25. 3'
100900	DR	39° 23. 3'	143° 23. 3'
101000	DR	39° 25. 5'	143° 22. 0'
101100	DR	39° 27. 9'	143° 20. 3'
101200	DR	39° 30. 6'	143° 19. 4'
101300	DR	39° 34. 7'	143° 17. 7'
101400	DR	39° 38. 1'	143° 16. 7'
101500	DR	39° 42. 0'	143° 14. 7'
101600	DR	39° 45. 0'	143° 13. 4'
101645	DR	39° 49. 4'	143° 11. 2'
101715	DR	39° 50. 9'	143° 10. 5'

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EVENT MS 025

NORTH ROSE - LEG 2

(Data Analysis Plan Experiment Number 14)

Schedule

Shallow Source (Starboard)
110900Z Sept to 120423Z Sept
29 Hz, 8 minutes ON/7 minutes OFF
at a constant power level starting on the
quarter hour

Deep Source
110919Z Sept to 110953Z Sept
111045Z Sept to 111222Z Sept
112215Z Sept to 112250Z Sept
11, 23, 38 100 Hz, 8 minutes ON/7 minutes OFF
each frequency at a constant power level,
repeated every hour

Summary

The shallow source transmitted at an average
level of 178 ± 2 dB/ μ Pa. The deep source
only transmitted for approximately three hours,
and source levels were not steady.

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TABLE 29

EVENT MS 025

NORTH ROSE LEG 2

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
110900 to 110908	29	177	20	
110915 to 110923	29	178	20	
110930 to 110938	29	176	20	
110945 to 110953	29	176	20	
111000 to 111008	29	177	20	
111015 to 111023	29	177	20	
111030 to 111038	29	177	20	
111045 to 111053	29	176	20	
111100 to 111108	29	177	20	
111115 to 111123	29	178	20	
111130 to 111138	29	178	20	
111145 to 111153	29	178	20	
111200 to 111208	29	178	20	
111215 to 111223	29	178	20	
111230 to 111238	29	177	20	
111245 to 111253	29	179	20	
111300 to 111308	29	179	20	
111315 to 111323	29	178	20	
111330 to 111338	29	177	20	
111345 to 111353	29	177	20	
111400 to 111408	29	178	20	
111415 to 111423	29	176	20	
111430 to 111438	29	176	20	
111445 to 111453	29	177	20	
111500 to 111508	29	178	20	
111515 to 111523	29	179	20	
111530 to 111538	29	179	20	
111545 to 111553	29	178	20	
111600 to 111608	29	178	20	
111615 to 111623	29	176	18	
111630 to 111638	29	177	17	
111645 to 111653	29	180	17	
111700 to 111708	29	178	17	
111715 to 111723	29	178	17	
111730 to 111738	29	178	17	
111745 to 111753	29	178	17	
111800 to 111808	29	178	17	
111815 to 111823	29	178	17	

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TABLE 29 (Continued)

EVENT MS 025

NORTH ROSE LEG 2

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
111830 to 111838	29	179	17	
111845 to 111853	29	178	17	
111900 to 111908	29	178	17	
111915 to 111923	29	178	17	
111930 to 111938	29	178	17	
111945 to 111953	29	178	17	
112000 to 112008	29		17	
111015 to 112023	29	178	17	
112030 to 112038	29	177	17	
112045 to 112053	29	178	17	
112100 to 112108	29	178	17	
112115 to 112123	29	177	17	
112130 to 112138	29	176	20	
112145 to 112153	29	176	20	
112200 to 112208	29	177	20	
112215 to 112223	29	178	20	
112230 to 112238	29		20	
112245 to 112253	29	178	20	
112300 to 112308	29	178	20	
112315 to 112323	29	178	20	
112330 to 112338	29	179	20	
112345 to 112353	29	179	20	
120000 to 120008	29	179	20	
120015 to 120023	29	179	18	
120030 to 120038	29	179	18	
120045 to 120053	29	179	18	
120100 to 120108	29	179	18	
120115 to 120123	29	180	18	
120130 to 120138	29		18	
120145 to 120153	29	180	18	
120200 to 120208	29	179	18	
120215 to 120223	29	180	18	
120230 to 120238	29	178	18	
120245 to 120253	29	179	18	
120300 to 120308	29	177	18	
120315 to 120323	29	179	20	
120330 to 120338	29		20	

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TABLE 29 (Continued)

EVENT MS 025

NORTH ROSE LEG 2

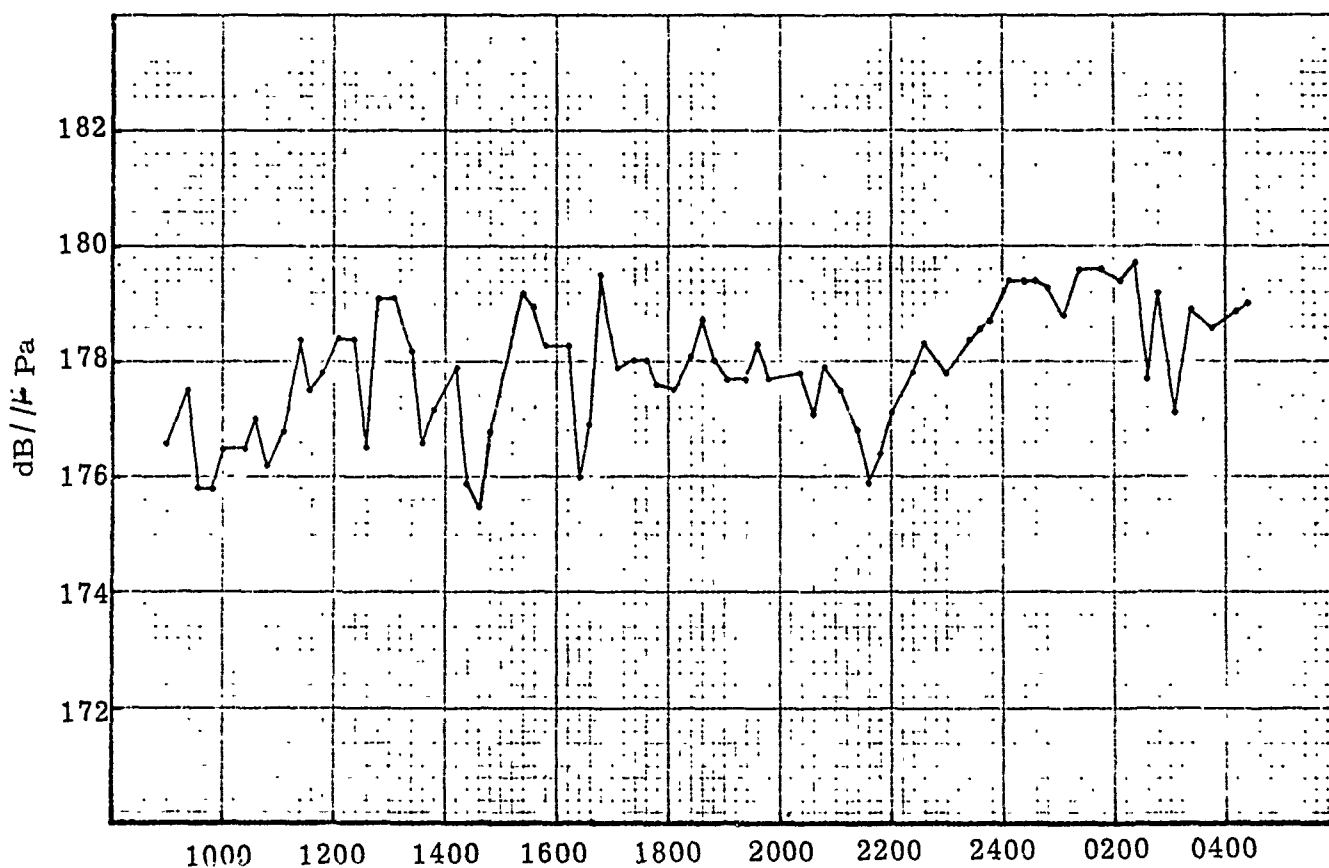
SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
120345 to 120353	29	179	20	
120400 to 120408	29	179	20	
120415 to 120423	29	179	20	

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EVENT MS 025
NORTH ROSE - LEG 2
SHALLOW SOURCE
29 Hz



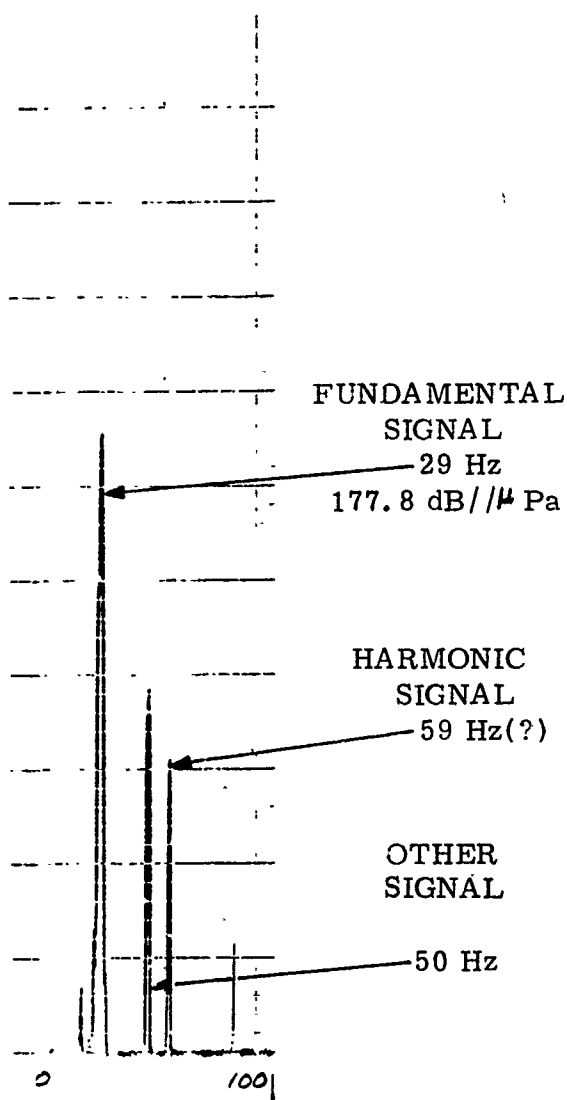
TIME
GMT 11 & 12 Sept 1973

FIGURE 58

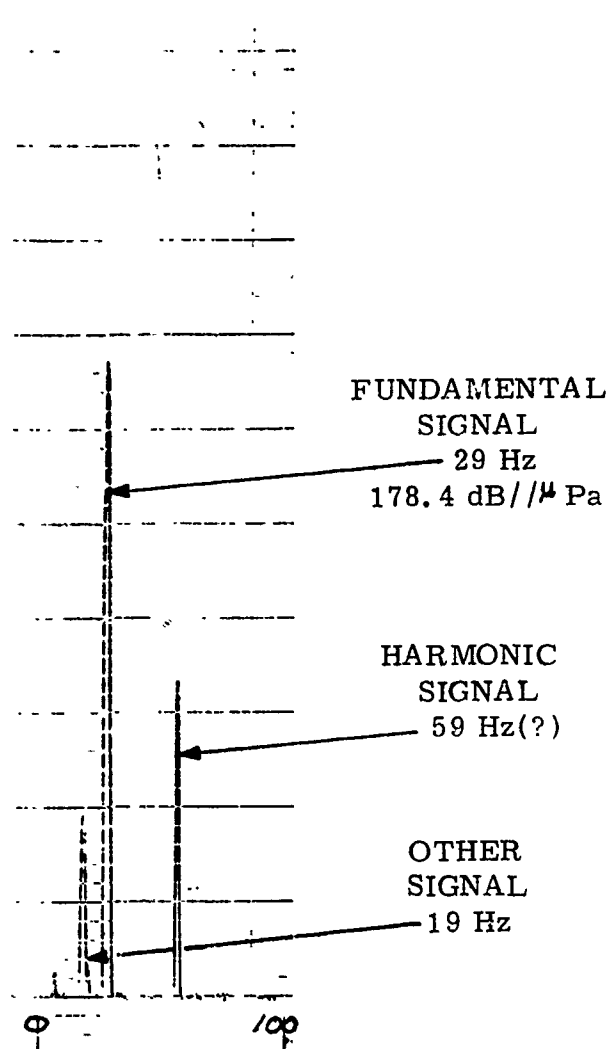
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EVENT MS 025
NORTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 14)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
111149Z SEPT 1973



FREQUENCY
111204Z SEPT 1973

SHALLOW SOURCE

FIGURE 59

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TABLE 30

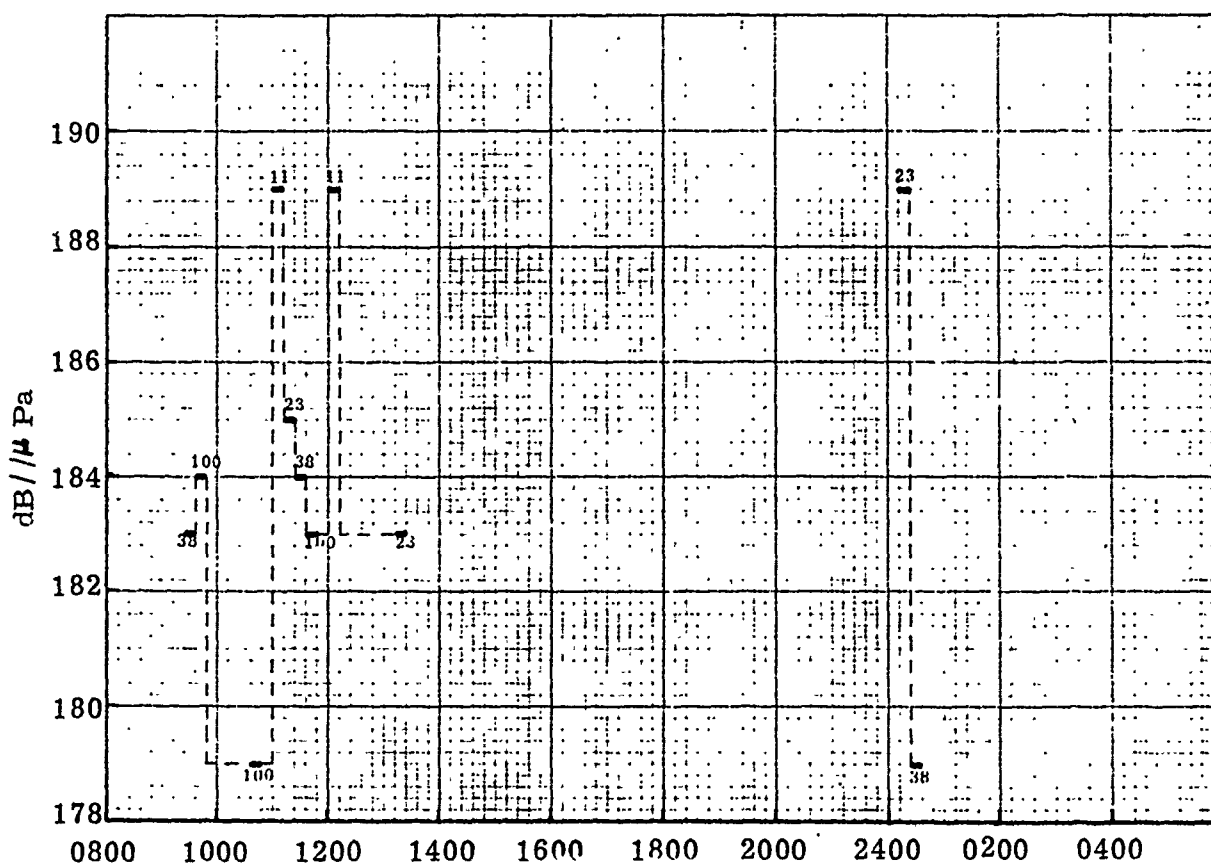
EVENT MS 025
NORTH ROSE LEG 2

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
110919 to 110923	23		130	System down
110930 to 110938	38	183	119	
110945 to 110953	100	184	111	
111045 to 111050	100	179	106	System down
111100 to 111108	11	189	106	
111115 to 111123	23	185	106	
111130 to 111138	38	184	103	
111145 to 111153	100	183	103	
111200 to 111208	11	189	101	
111215 to 111223	23	183	101	
112215 to 112217	23		112	
112221 to 112223	23	189	112	System down
112230 to 112238	38	179	112	
112245 to 112250	100		112	

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EVENT MS 025
NORTH ROSE - LEG 2
DEEP SOURCE
11, 23, 38, 100, Hz



TIME

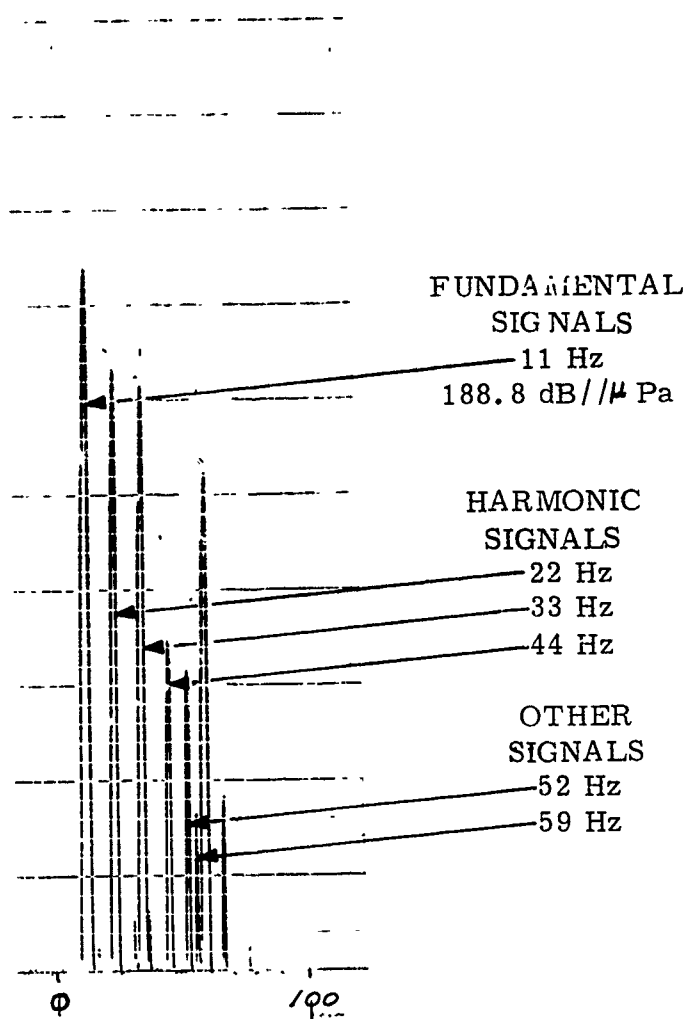
GMT 11 & 12 Sept 1973

FIGURE 60

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EVENT MS 025
NORTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 14)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
111201Z SEPT 1973

DEEP SOURCE

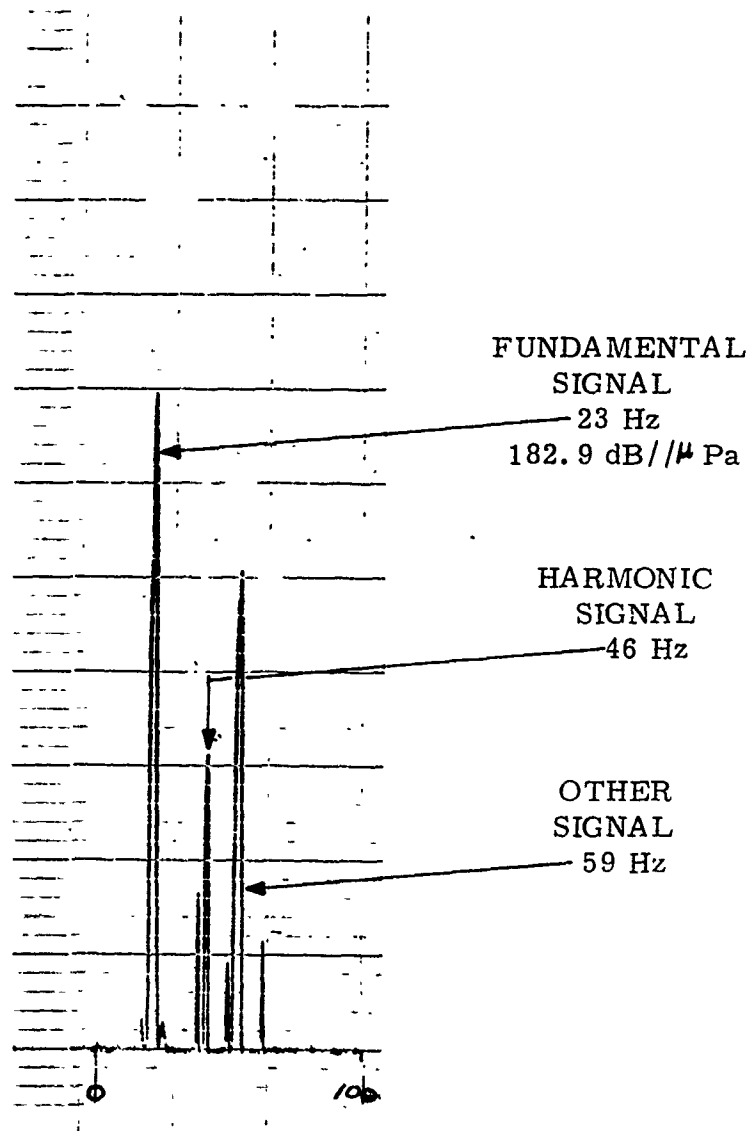
FIGURE 61

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EVENT MS 025
NORTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 14)
SAMPLE SIGNAL SPECTRUM RECORDING



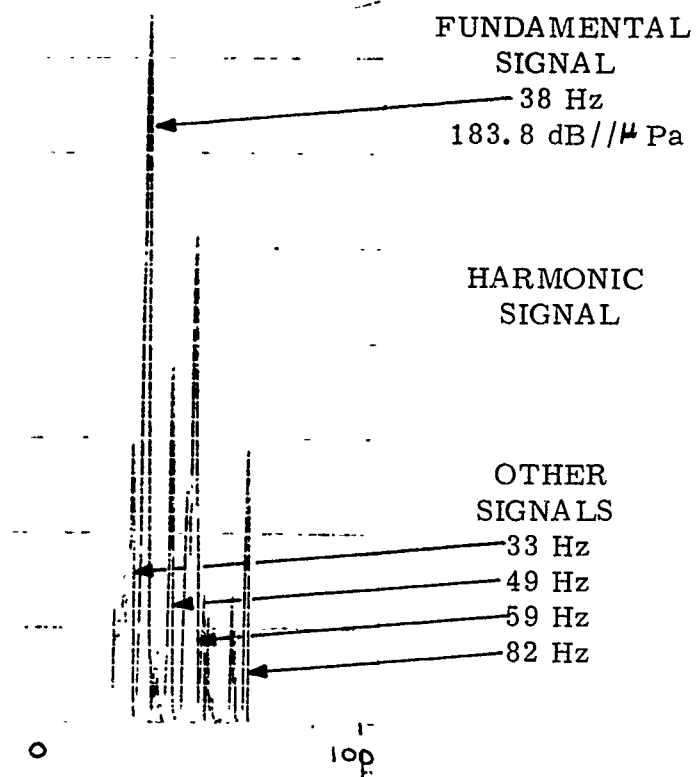
FREQUENCY
111218Z SEPT 1973

DEEP SOURCE
FIGURE 62

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EVENT MS 025
NORTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 14)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
111134Z SEPT 1973

DEEP SOURCE

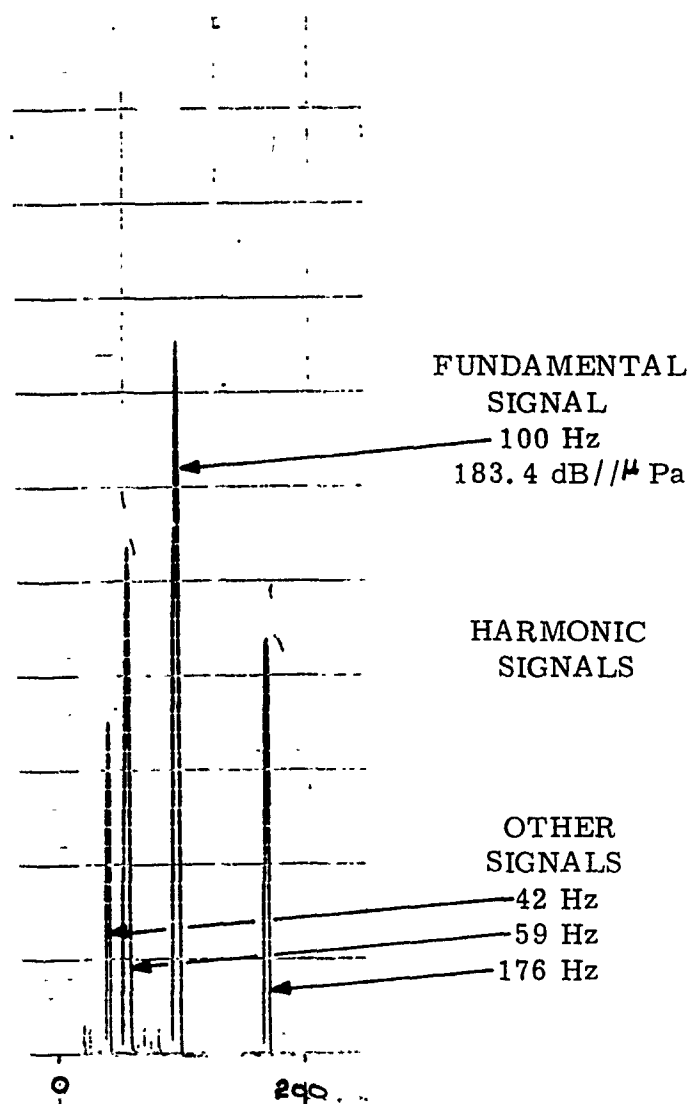
FIGURE 63

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EVENT MS 025
NORTH ROSE - LEG 2
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 14)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
11114/Z SEPT 1973

DEEP SOURCE

FIGURE 64

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TABLE 31

EVENT MS 025

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
110900	DR	39° 50.8'	143° 51.2'
110934	F	39° 51.4'	143° 49.3'
111030	DR	39° 47.9'	143° 47.6'
111118	F	39° 44.8'	143° 44.8'
111200	DR	39° 42.0'	143° 42.8'
111300	DR	39° 37.9'	143° 40.7'
111400	DR	39° 33.8'	143° 38.0'
111500	DR	39° 32.2'	143° 38.4'
111600	DR	39° 30.8'	143° 37.0'
111700	DR	39° 25.8'	143° 33.8'
111800	DR	39° 20.9'	143° 31.8'
111845	F	39° 17.1'	143° 30.7'
111930	F	39° 13.1'	143° 29.7'
112000	DR	39° 11.1'	143° 28.9'
112100	DR	39° 06.1'	143° 26.6'
112130	F	39° 04.7'	143° 26.5'
112215	DR	39° 03.3'	143° 25.2'
112300	F	39° 01.1'	143° 22.8'
120015	DR	38° 56.2'	143° 19.1'
120045	F	38° 53.5'	143° 17.4'
120100	F	38° 52.3'	143° 16.6'
120145	F	38° 49.5'	143° 14.9'
120230	F	38° 46.1'	143° 13.7'
120315	F	38° 43.3'	143° 12.4'
120400	DR	38° 40.2'	143° 10.8'

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EVENT MS 027

NORTH ROSE - LEG 3

(Data Analysis Plan Experiment Number 15)

Schedule

Shallow Source (Starboard)
121200Z Sept to 130753Z Sept
29 Hz, 8 minutes ON/7 minutes OFF
at a constant power level repeated every
quarter hour

Deep Source
121345Z Sept to 130308Z Sept
11, 23, 38, 100 Hz, 8 minutes ON/7 minutes
OFF each frequency at a constant power level
repeated every hour

Summary

The shallow source transmission was steady
at 179 ± 1 dB/ μ Pa. The deep source did
transmit at the required frequencies on schedule,
but power levels were erratic, and no trend could
be determined.

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TABLE 32

EVENT MS 027

NORTH ROSE LEG 3

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
121200 to 121208	29		17	
121215 to 121223	29	179	17	
121230 to 121238	29	178	18	
121245 to 121253	29	177	18	
121300 to 121308	29	177	18	
121315 to 121323	29	178	19	
121330 to 121338	29	179	18	
121345 to 121353	29	179	18	
121400 to 121408	29	180	19	
121415 to 121423	29	178	19	
121430 to 121438	29	179	19	
121445 to 121453	29	178	19	
121500 to 121508	29	178	18	
121515 to 121523	29	180	18	
121530 to 121538	29	179	18	
121545 to 121553	29	178	18	
121600 to 121608	29	179	18	
121615 to 121623	29	180	18	
121630 to 121638	29	180	18	
121645 to 121653	29	177	18	
121700 to 121708	29	178	18	
121715 to 121723	29	179	18	
121730 to 121738	29	179	18	
121745 to 121753	29	178	18	
121800 to 121808	29	178	18	
121815 to 121823	29	180	18	
121830 to 121838	29	178	18	
121845 to 121853	29	178	18	
121900 to 121908	29	180	18	
121915 to 121923	29	180	18	
121930 to 121938	29	180	18	
121945 to 121953	29	180	18	
122000 to 122008	29	179	18	
122015 to 122023	29	177	18	
122030 to 122038	29	179	18	
122045 to 122053	29	179	18	
122100 to 122108	29	178	18	
122115 to 122123	29	180	18	

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TABLE 32 (Continued)

EVENT MS 027

NORTH ROSE LEG 3

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
122130 to 122138	29	180	18	
122145 to 122153	29	180	18	
122200 to 122208	29	179	18	
122215 to 122223	29	179	18	
122230 to 122238	29	179	18	
122245 to 122253	29	179	19	
122300 to 122308	29	180	19	
122315 to 122323	29	180	19	
122330 to 122338	29	179	19	
122345 to 122353	29	178	19	
130000 to 130008	29	180	19	
130015 to 130023	29	180	19	
130030 to 130038	29	180	19	
130045 to 130053	29	180	19	
130100 to 130108	29	180	19	
130115 to 130123	29	180	19	
130130 to 130138	29	180	19	
130145 to 130153	29	180	19	
130200 to 130208	29	179	19	
130215 to 130223	29	180	19	
130230 to 130238	29	180	19	
130245 to 130253	29	180	19	
130300 to 130308	29	180	19	
130315 to 130323	29	180	19	
130330 to 130338	29	179	19	
130345 to 130353	29	180	19	
130400 to 130408	29	180	19	
130415 to 130423	29	180	19	
130430 to 130438	29	180	19	
130445 to 130453	29	180	19	
130500 to 130508	29	179	19	
130515 to 130523	29	177	19	
130530 to 130538	29	179	19	
130545 to 130553	29	179	19	
130600 to 130608	29	178	19	
130615 to 130623	29	178	19	
130630 to 130638	29	179	19	

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TABLE 32 (Continued)

EVENT MS 027

NORTH ROSE LEG 3

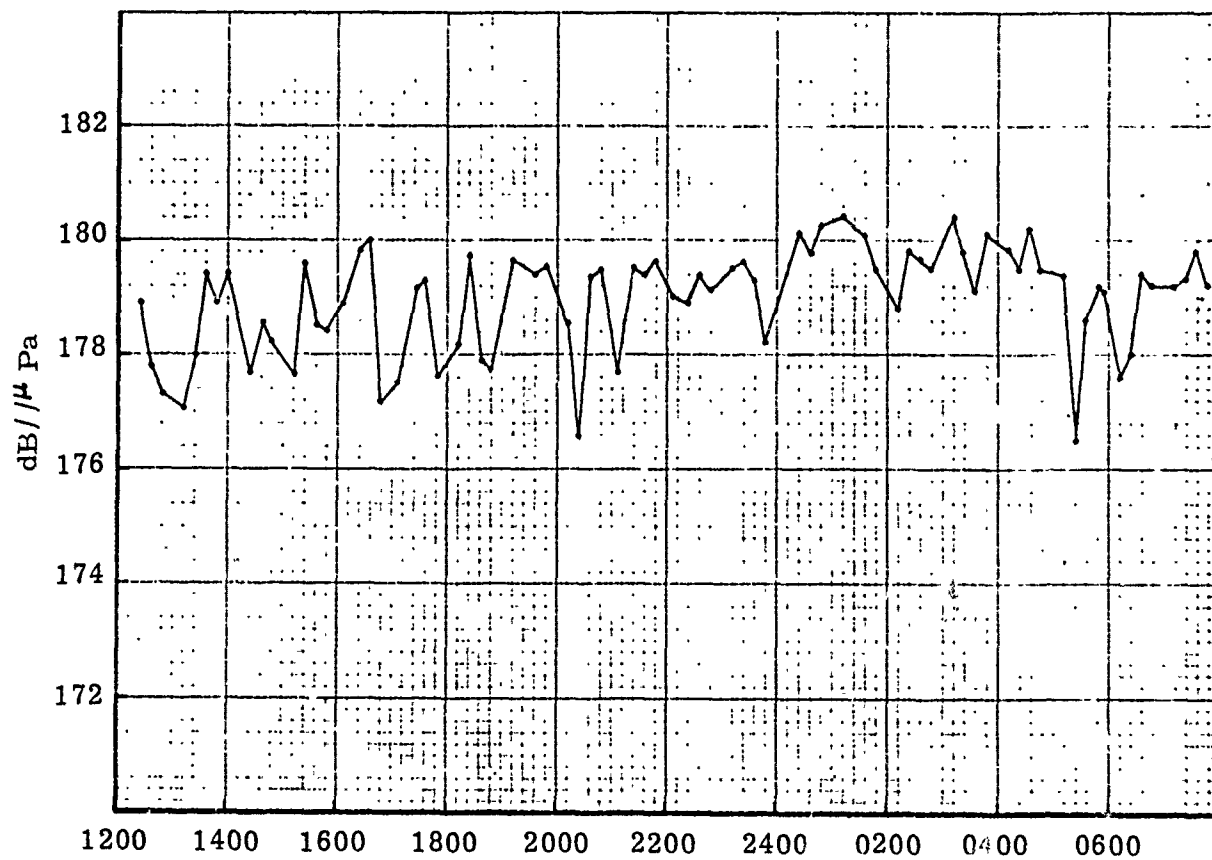
SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
130645 to 130653	29	179	19	
130700 to 130708	29	179	19	
130715 to 130723	29	179	19	
130730 to 130738	29	180	19	
130745 to 130753	29	179	19	

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EVENT MS 027
NORTH ROSE - LEG 3
SHALLOW SOURCE
29 Hz



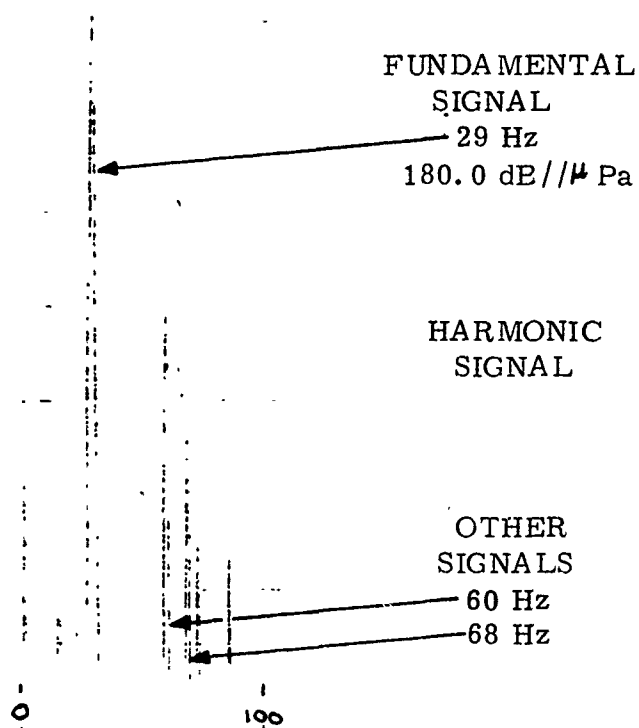
TIME
GMT 12 & 13 Sept

FIGURE 65

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EVENT MS 027
NORTH ROSE - LEG 3
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 15)
SAMPLE SIGNAL SPECTRUM RECORDING



FUNDAMENTAL
121634Z SEPT 1973

SHALLOW SOURCE

FIGURE 66

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TABLE 33

EVENT MS 027

NORTH ROSE LEG 3

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
121345 to 121353	100		124	No hydrophone output
121400 to 121408				
121415 to 121423	23	182	123	
121430 to 121438	38	185	122	
121445 to 121453	100	182	104	
121500 to 121508	11	184	104	
121515 to 121524	23	185	104	
121530 to 121538	38	182	104	
121545 to 121553	100	182	105	
121600 to 121608	11	186	105	
121615 to 121623	23	184	105	
121630 to 121638	38	183	105	
121645 to 121653	100	179	105	
121700 to 121708	11	185	104	
121715 to 121723	23	185	104	
121730 to 121738	38	179	104	
121745 to 121753	100	181	104	One minute 24 seconds late going OFF
121800 to 121808	11	186	104	
121815 to 121823	23	184	104	
121830 to 121838	38	183	104	
121845 to 121853	100	183	104	
121900 to 121908	11	186	104	
121915 to 121953	23	199	104	
121930 to 121938	38		104	
121945 to 121953	100	180	104	
122000 to 122009	11	183	104	
122015 to 122023	23	183	104	
122030 to 122038	38	180	96	
122045 to 122053	100	181	96	
122100 to 122108	11	185	96	
122115 to 122123	23	187	96	One minute 2 seconds late going OFF
122130 to 122138	38	183	96	
122145 to 122153	100	184	101	
122200 to 122208	11	188	101	
122215 to 122223	23	187	101	
122230 to 122238	38	185	101	
122245 to 122253	100	184	105	
122300 to 122308	11	187	105	

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TABLE 33 (Continued)

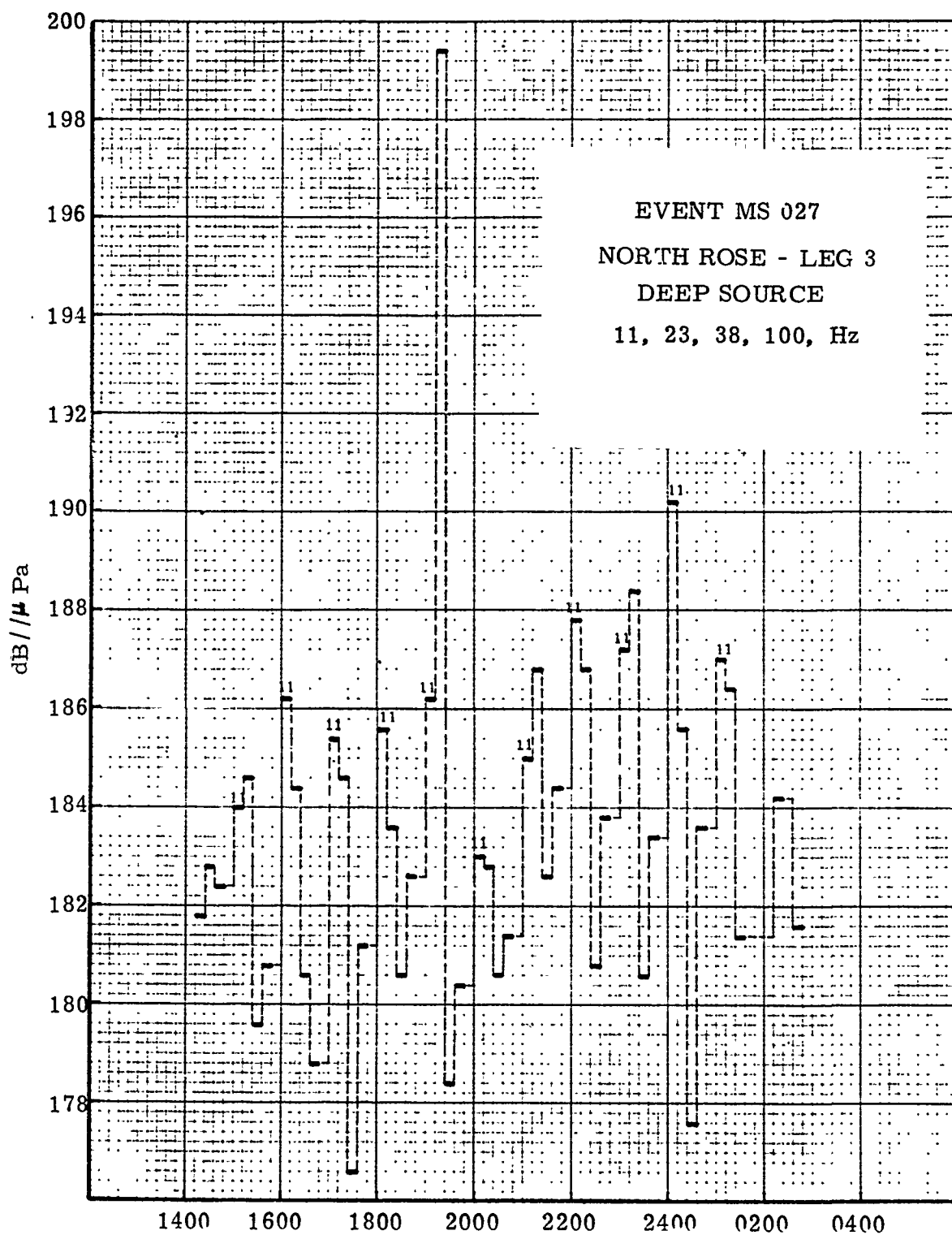
EVENT MS 027

NORTH ROSE LEG 3

DEEP SOURCE (continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
122315 to 122323	23	188	105	Frequencies were accidentally switched Unable to transmit due to equipment problems
122330 to 122338	38	183	105	
122345 to 122353	100	183	105	
130000 to 130008	11	190	108	
130015 to 130023	23	186	108	
130030 to 130038	38	183	108	
130045 to 130053	100	184	107	
130100 to 130108	11	187	107	
130115 to 130123	23	186	110	
130130 to 130138	38	180	110	
130145 to 130153	100	182	110	
130200 to 130208	11		122	
130215 to 130223	38	183	122	
130230 to 130238	23	184	122	
130245 to 130253	100		106	
130300 to 130308			105	

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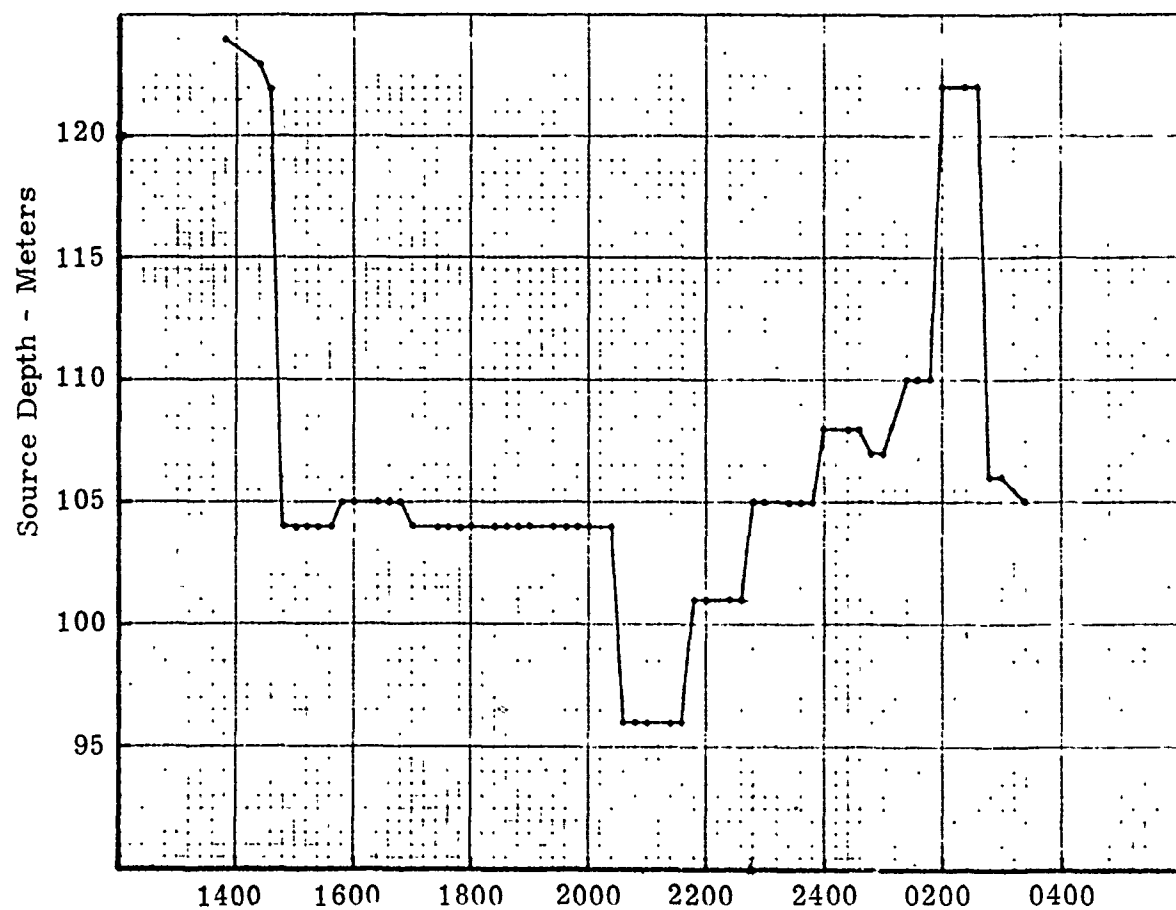
TIME
GMT 12 & 13 Sept 1973

FIGURE 67
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EVENT MS 027
NORTH ROSE - LEG 3
DEEP SOURCE



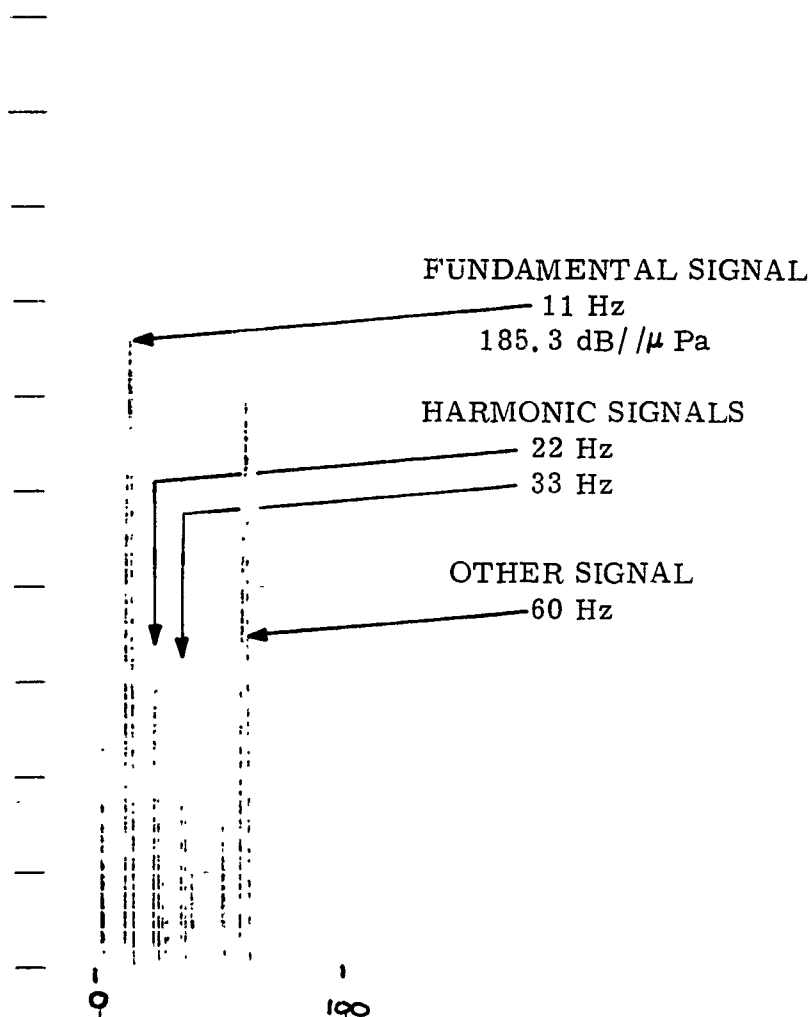
TIME
GMT 12 & 13 Sept 1973

FIGURE 68

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EVENT MS 027
NORTH ROSE - LEG 3
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 15)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
121703Z SEP 1973

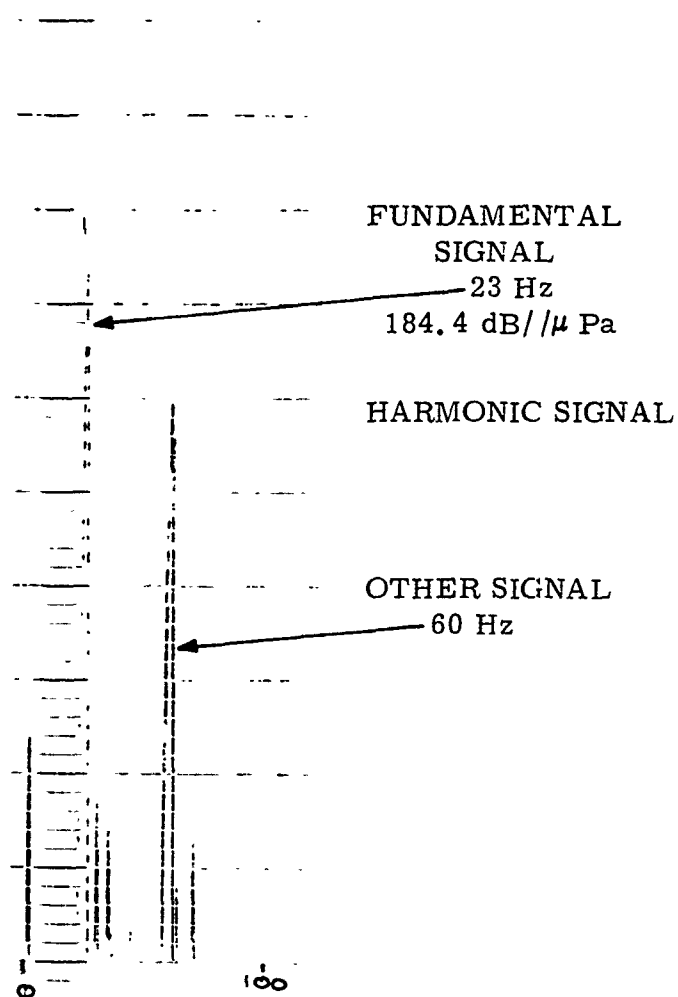
DEEP SOURCE

FIGURE 69

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EVENT MS 027
NORTH ROSE - LEG 3
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 15)
SAMPLE SIGNAL SPECTRUM RECORDING



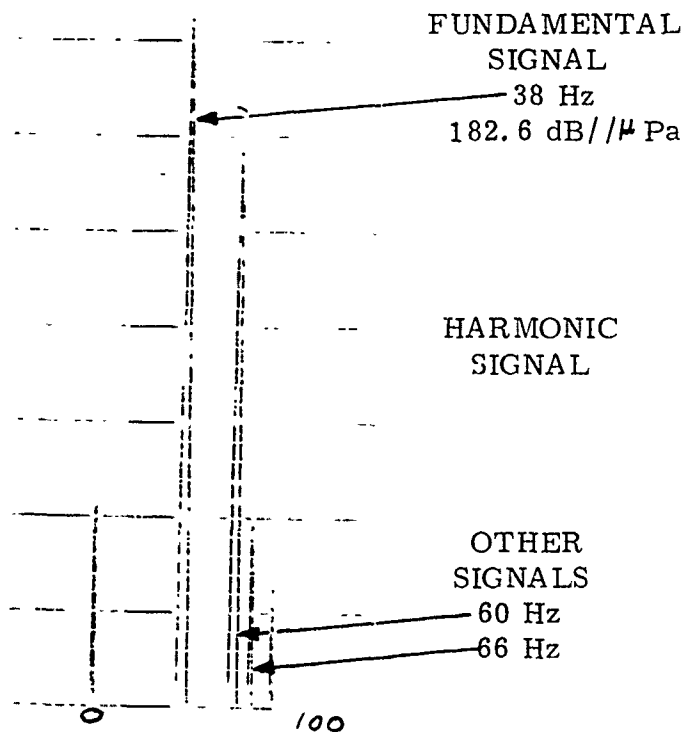
FREQUENCY
121616Z SEPT 1973

DEEP SOURCE

FIGURE 70

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EVENT MS 027
NORTH ROSE - LEG 3
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 15)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
121631Z SEPT 1973

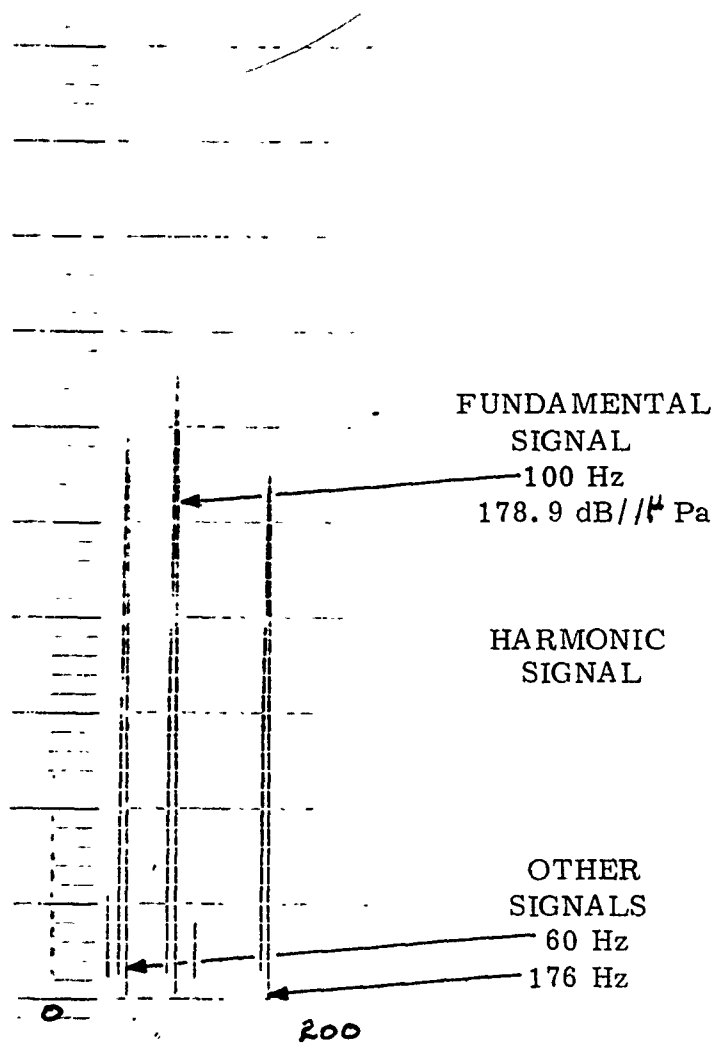
DEEP SOURCE

FIGURE 71
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EVENT MS 027
NORTH ROSE - LEG 3
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 15)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
121647Z SEPT 1973

DEEP SOURCE
FIGURE 72
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TABLE 34

EVENT MS 027
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
121200	DR	38° 53.5'	142° 44.9'
121230	F	38° 54.7'	142° 50.1'
121300	DR	38° 55.0'	142° 51.1'
121400	DR*	38° 56.2'	142° 53.6'
121500	DR*	38° 57.5'	142° 58.4'
121600	DR*	39° 00.0'	143° 03.1'
121700	DR*	39° 03.1'	143° 08.8'
121800	F	39° 05.8'	143° 12.8'
121900	DR	39° 09.4'	143° 17.5'
122000	DR	39° 10.6'	143° 21.8'
122030	F	39° 12.8'	143° 24.2'
122100	DR	39° 14.0'	143° 26.6'
122200	F	39° 16.9'	143° 31.3'
122300	DR	39° 18.9'	143° 36.7'
130000	F	39° 21.0'	143° 40.9'
130100	F	39° 23.5'	143° 45.7'
130200	DR	39° 24.5'	143° 49.8'
130300	F	39° 26.2'	143° 53.4'
130400	F	39° 27.9'	143° 57.6'
130500	F	39° 30.9'	144° 02.3'
130600	F	39° 32.4'	144° 06.8'
130700	DR	39° 33.8'	144° 09.9'
130745	DR	39° 35.2'	144° 12.8'

*Satellite navigation fixes were obtained between these DRs.

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EVENT MS 031'

DEPTH CYCLE DOWN

(Stationary Transmission)

(Data Analysis Plan Experiment Number 18)

Schedule

Shallow Source (Starboard)

151000Z Sept to 151023Z Sept

38 Hz, 8 minutes ON/7 minutes OFF
at constant power level repeated twice

Deep Source

151045Z Sept to 151538Z Sept

38 Hz, 8 minutes ON/7 minutes OFF
at constant power level and decreasing
depths in 18 meter increments. Two
transmission cycles per depth, and 22 minutes
time allowed to achieve next depth

Summary

The shallow source was only used for the first depth transmission to conserve time while deep source was being worked on. Transmissions at a particular depth level were relatively constant, and the overall average transmission power level was 197 ± 1 dB/ μ Pa except for the 19 meter transmission, which was at 193.5 dB/ μ Pa.

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TABLE 35

EVENT MS 031'

DEPTH CYCLE DOWN

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
151000 to 151008	38	194	19	Two minutes 30 seconds late due to hydraulic problems Forty seconds late on starting
151015 to 151023	38	194	19	
151045 to 151053	38	197	37	
151100 to 151108	38	198	37	
151130 to 151138	38	195	56	
151145 to 151153	38	196	56	
151215 to 151223	38	196	72	
151230 to 151238	38	197	72	
151302 to 151308	38	198	94	
151315 to 151323	38	197	94	
151345 to 151353	38	198	110	
151400 to 151408	38	198	110	
151430 to 151438	38	197	128	
151445 to 151453	38	199	128	
151515 to 151523	38	196	136	
151530 to 151538	38	197	136	

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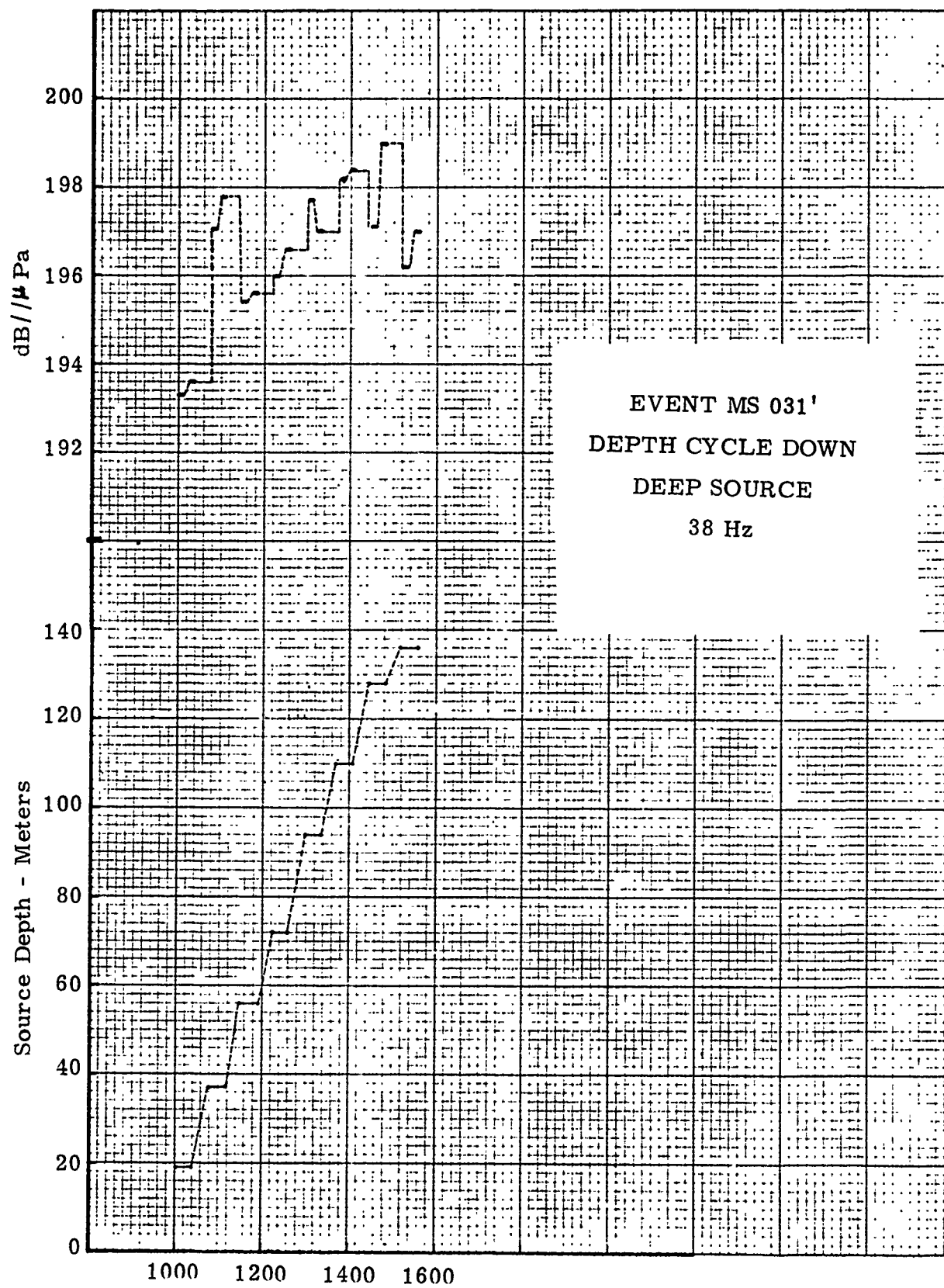


FIGURE 73

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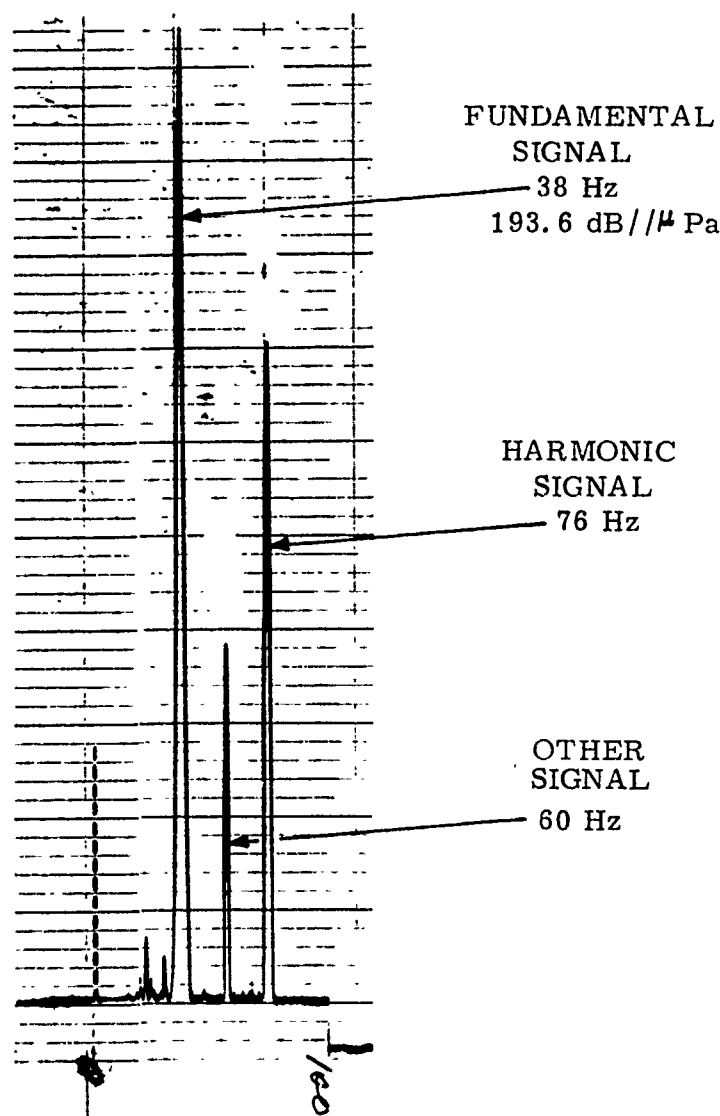
TIME

GMT 15 Sept 1973

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EVENT MS 031'
DEPTH CYCLE DOWN
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
151015Z SEPT 1973

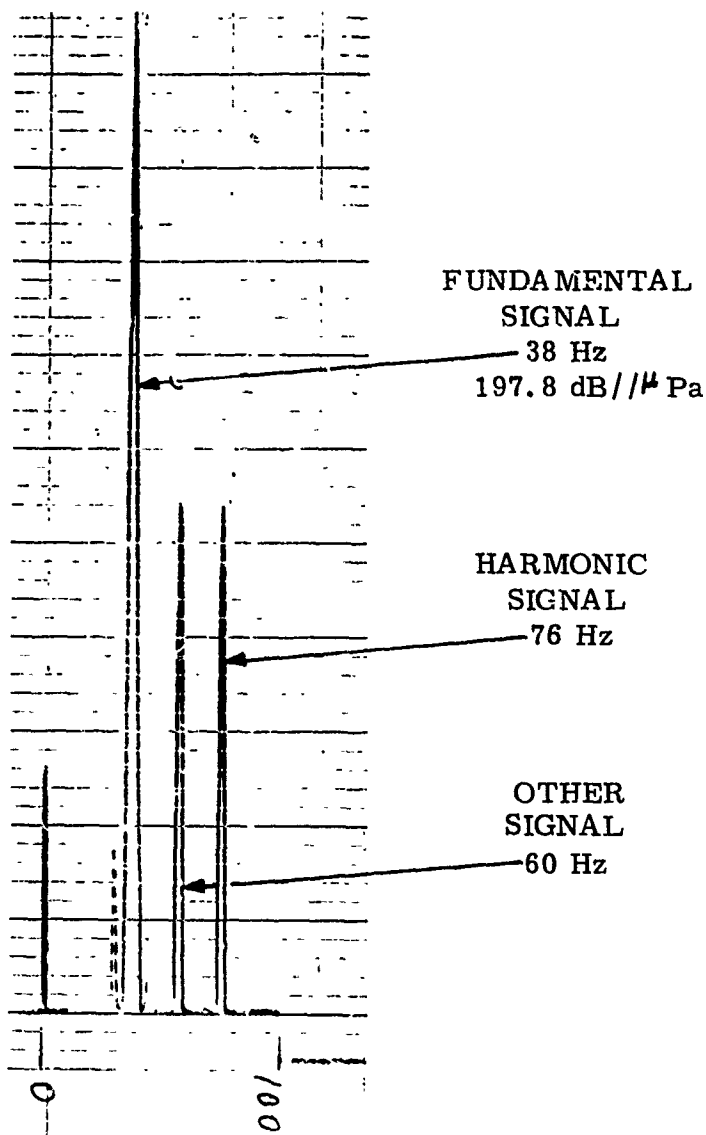
SHALLOW SOURCE
19 METER DEPTH

FIGURE 74

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EVENT MS 031'
DEPTH CYCLE DOWN
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
151100Z SEPT 1973

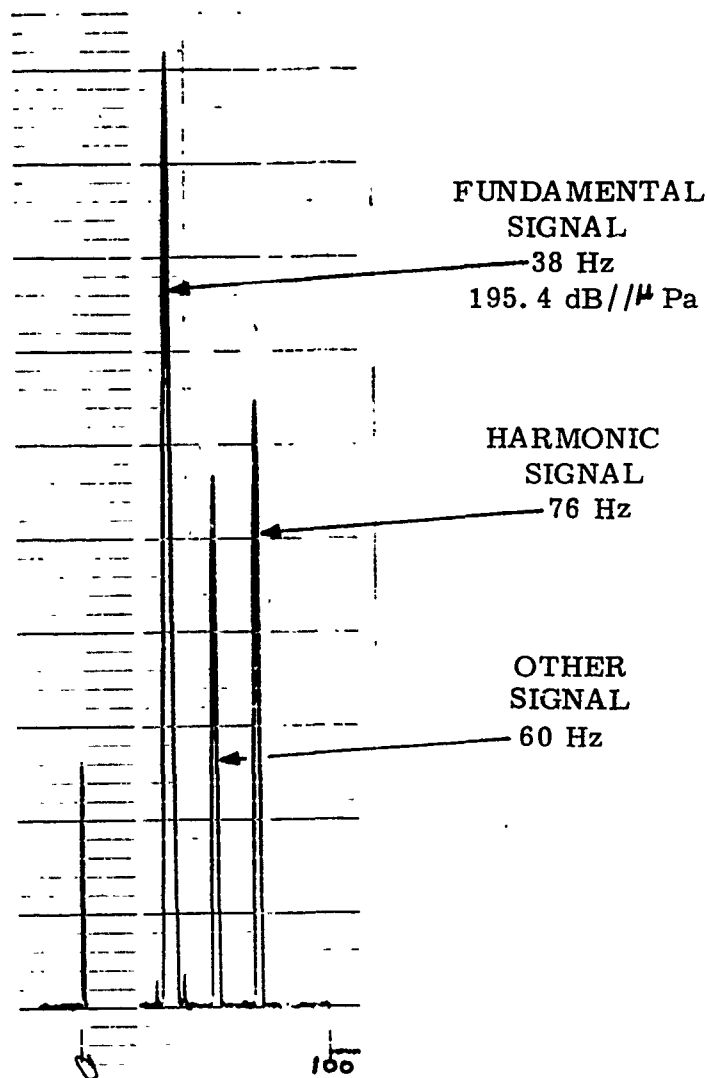
DEEP SOURCE
37 METER DEPTH
FIGURE 75

III-117

CONFIDENTIAL

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EVENT MS 031'
DEPTH CYCLE DOWN
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
151130Z SEPT 1973

DEEP SOURCE
56 METER DEPTH

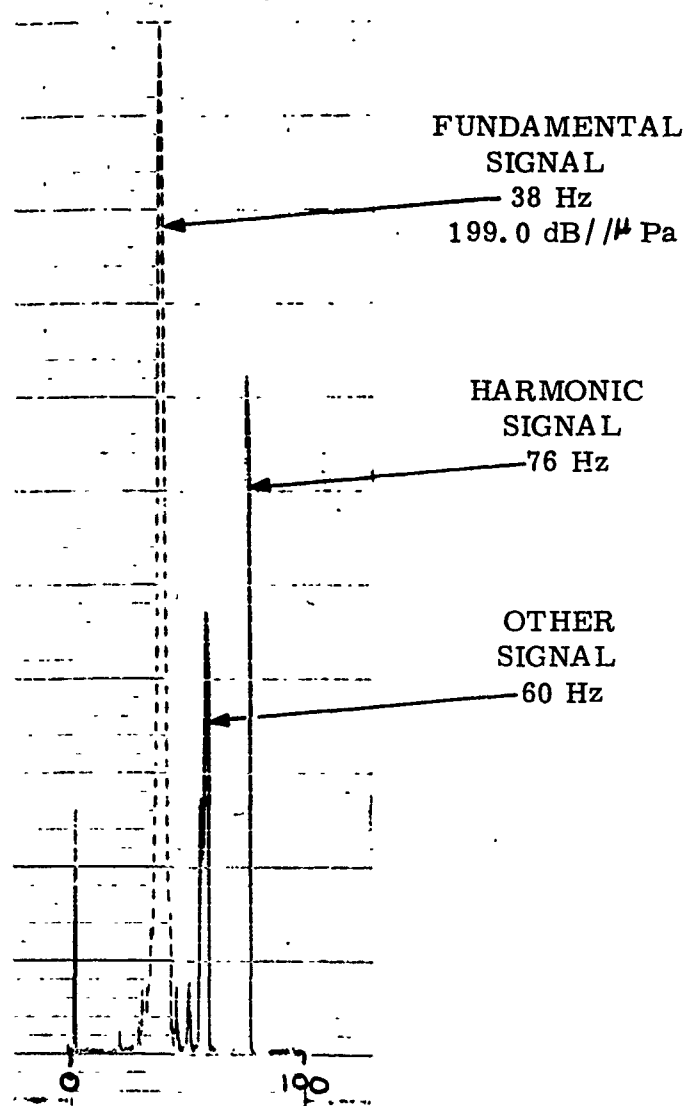
FIGURE 76

III-118

CONFIDENTIAL

CONFIDENTIAL

EVENT MS 031'
DEPTH CYCLE DOWN
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
151446Z SEPT 1973

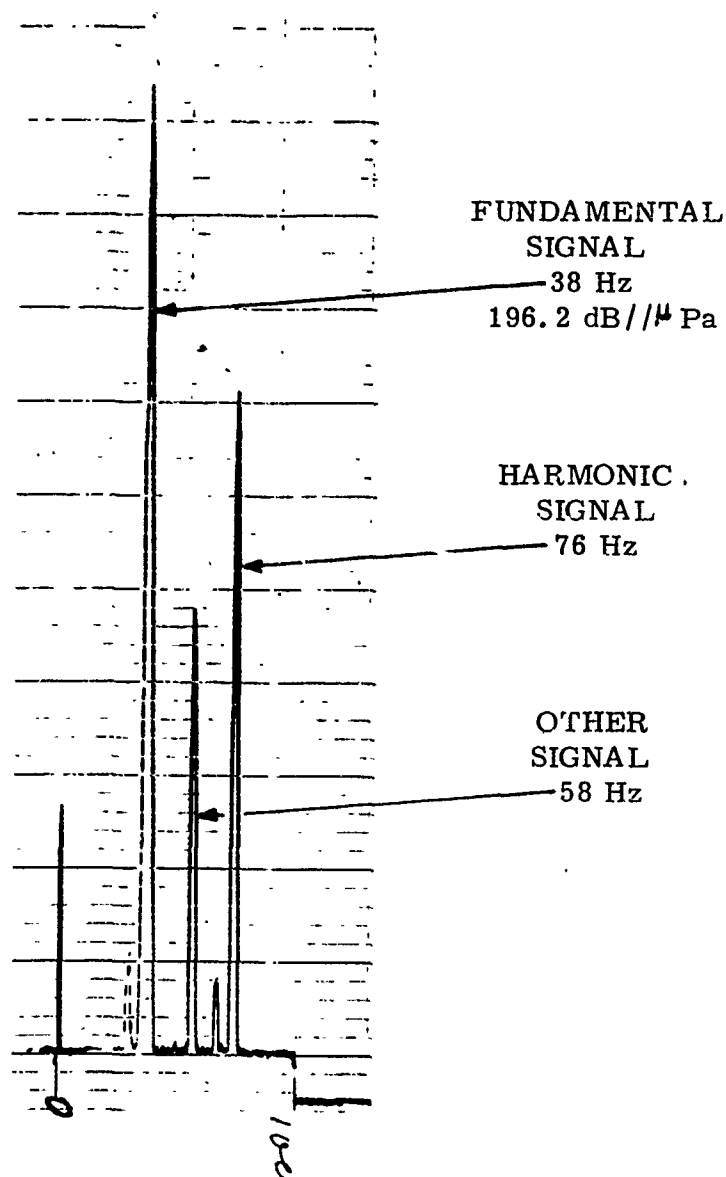
DEEP SOURCE
128 METER DEPTH

FIGURE 77
III-119

CONFIDENTIAL

CONFIDENTIAL

EVENT MS 031'
DEPTH CYCLE DOWN
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
151517Z SEPT 1973

DEEP SOURCE
136 METER DEPTH

FIGURE 78

III-120

CONFIDENTIAL

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TABLE 36

EVENT MS 031'

DEPTH CYCLE DOWN

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
151000	F	40° 00.6'	146° 25.3'
151100	DR	40° 00.6'	146° 25.3'
151215	F	40° 00.6'	146° 21.7'
151352	F	40° 01.5'	146° 17.2'
151510	F	40° 01.0'	146° 15.3'

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EVENT MS 031'

POWER CYCLE

(Stationary Transmission)

(Data Analysis Plan Experiment Number 19)

Schedule

Shallow Source (Starboard)

151700Z Sept to 152153Z Sept

11, 23, 38, 100 Hz, 8 minutes ON/7 minutes
OFF each frequency at five increasing power
levels

Deep Source

151700Z Sept to 152153Z Sept

100, 38, 23, 11 Hz, 8 minutes ON/7 minutes
OFF each frequency at five increasing power
levels

Summary

Shallow source operated in a more uniform fashion than the deep source as can be seen on the power versus time plots. Spectrum plots of the deep source indicated numerous extraneous frequencies were being transmitted. Depth was maintained at 18 ± 1 meters for the shallow source and 130 ± 2 meters for the deep source.

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TABLE 37
EVENT MS 031'
POWER CYCLE

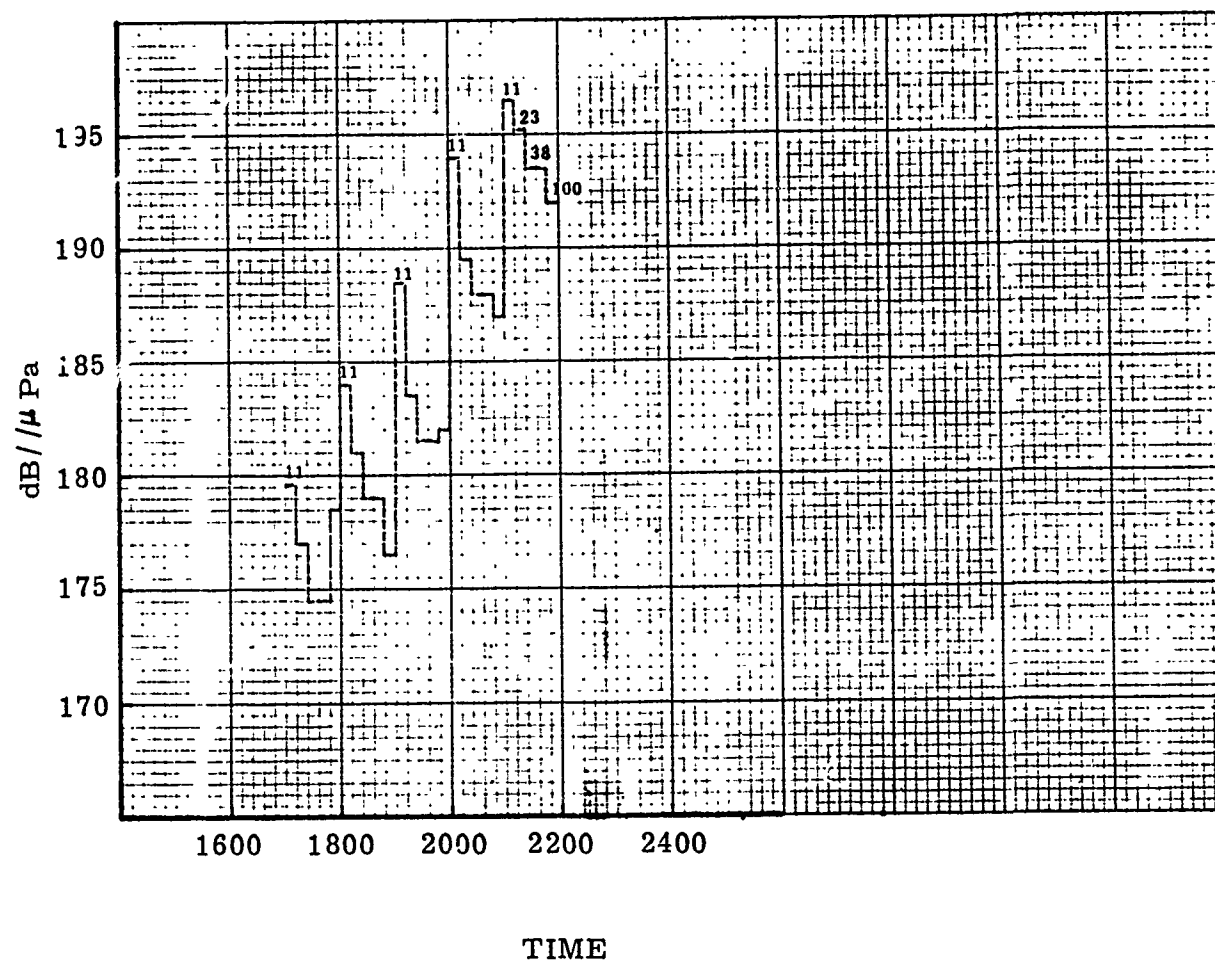
SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
151700 to 151708	11	180	19	One minute 24 seconds late on turning OFF
151715 to 151723	23	177	19	
151730 to 151738	38	175	19	
151745 to 151754	100	177	19	
151800 to 151808	11	184	19	
151815 to 151823	23	181	19	
151830 to 151838	38	178	19	
151845 to 151853	100	177	19	
151900 to 151908	11	189	19	
151915 to 151923	23	184	19	
151930 to 151938	38	182	19	
151945 to 151953	100	182	19	
152000 to 152008	11	194	19	
152015 to 152023	23	190	18	
152030 to 152038	38	188	18	
152045 to 152053	100	187	18	
152100 to 152108	11	197	18	
152115 to 152123	23	195	18	
152130 to 152138	38	193	18	
152145 to 152153	100	192	18	

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EVENT MS 031'
POWER CYCLE
SHALLOW SOURCE
11, 23, 38, 100, Hz



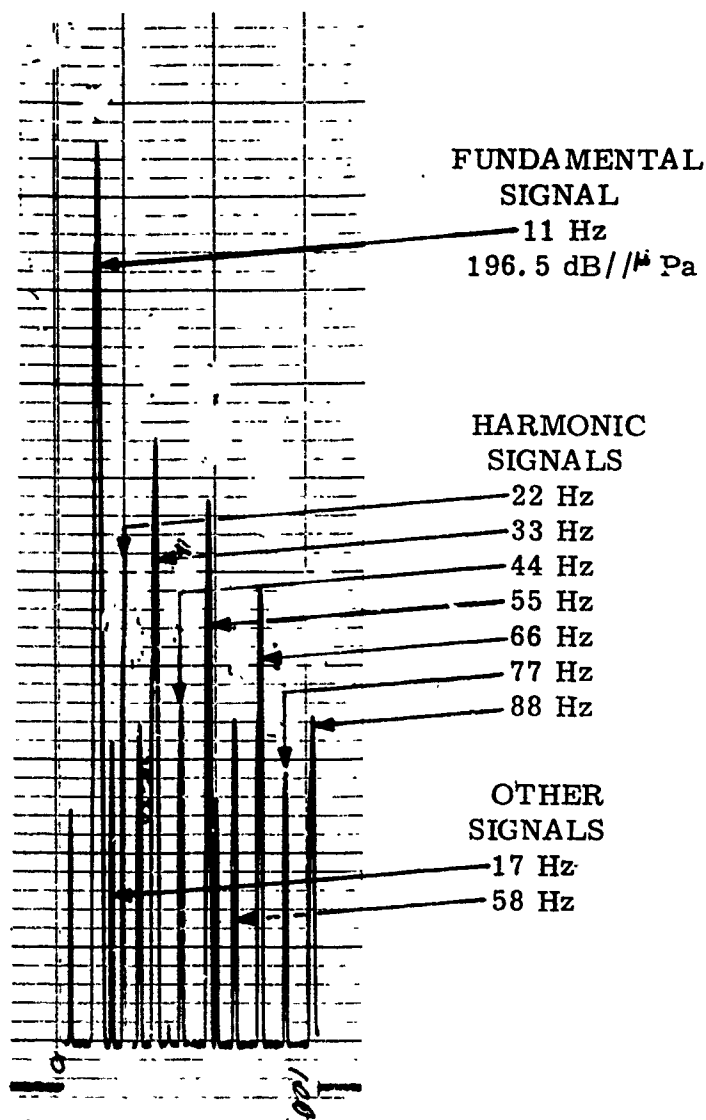
GMT 15 Sept 1973

FIGURE 79

CONFIDENTIAL

CONFIDENTIAL

EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



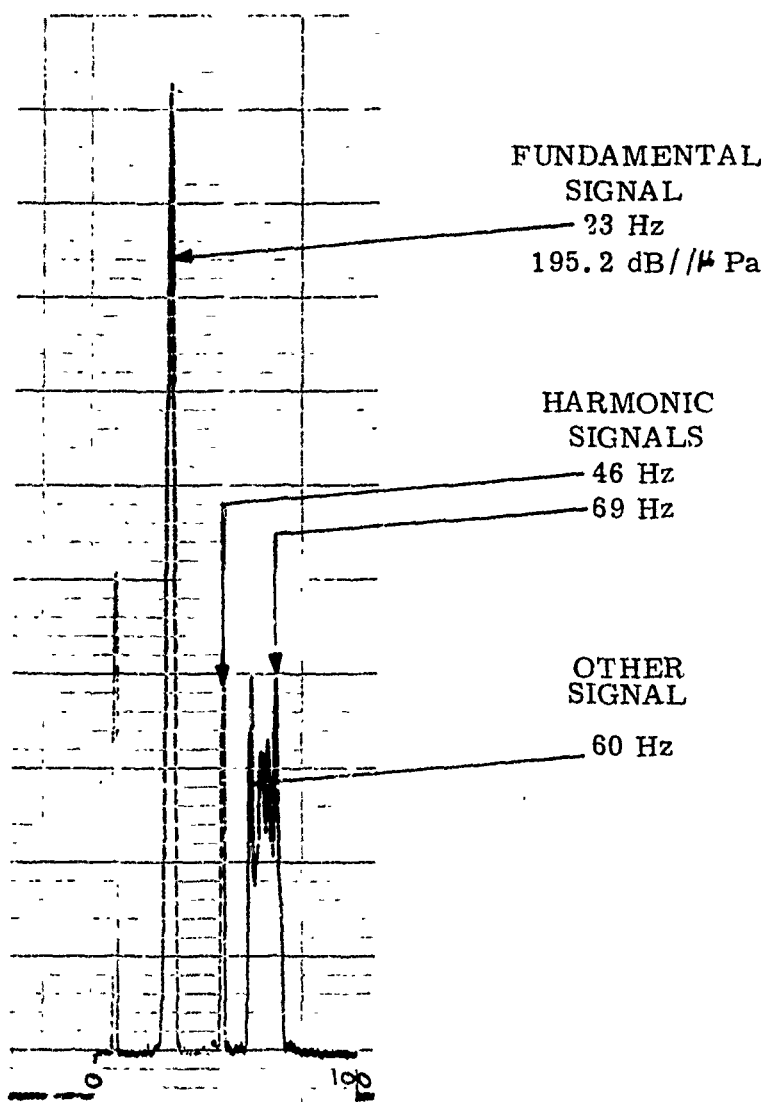
FREQUENCY
152104Z SEPT 1973

SHALLOW SOURCE
FIGURE 80
III-126

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EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
152118Z SEPT 1973

SHALLOW SOURCE

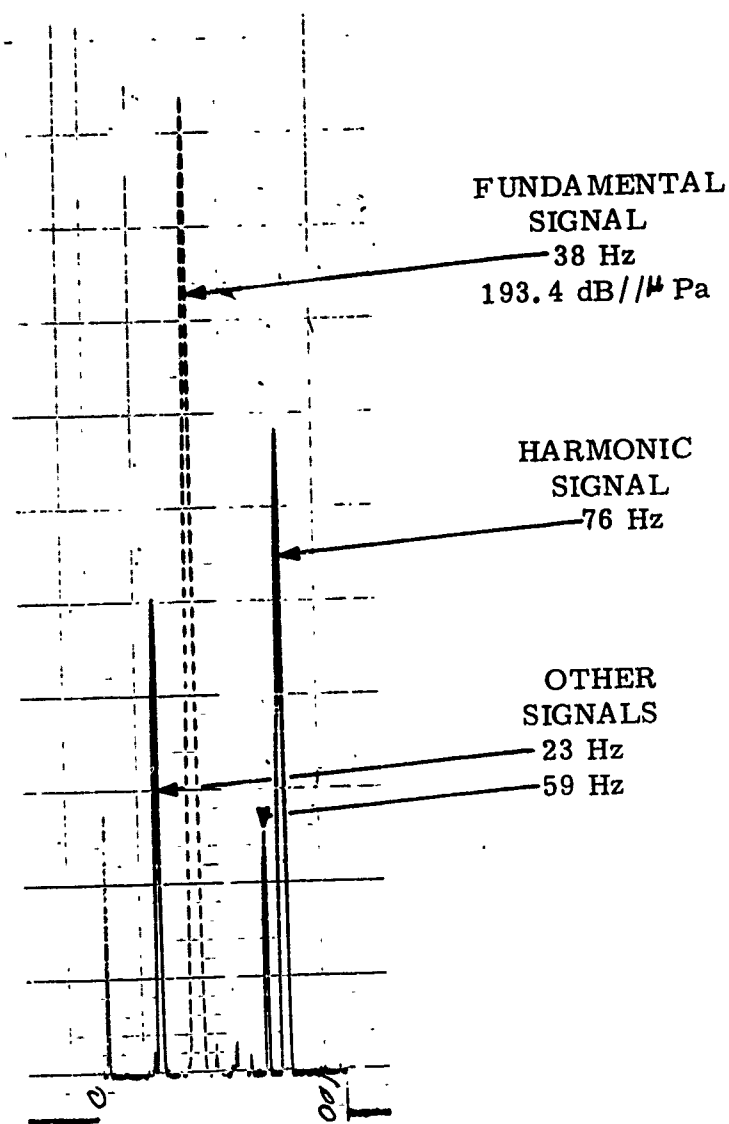
FIGURE 81

III-127

CONFIDENTIAL

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EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING

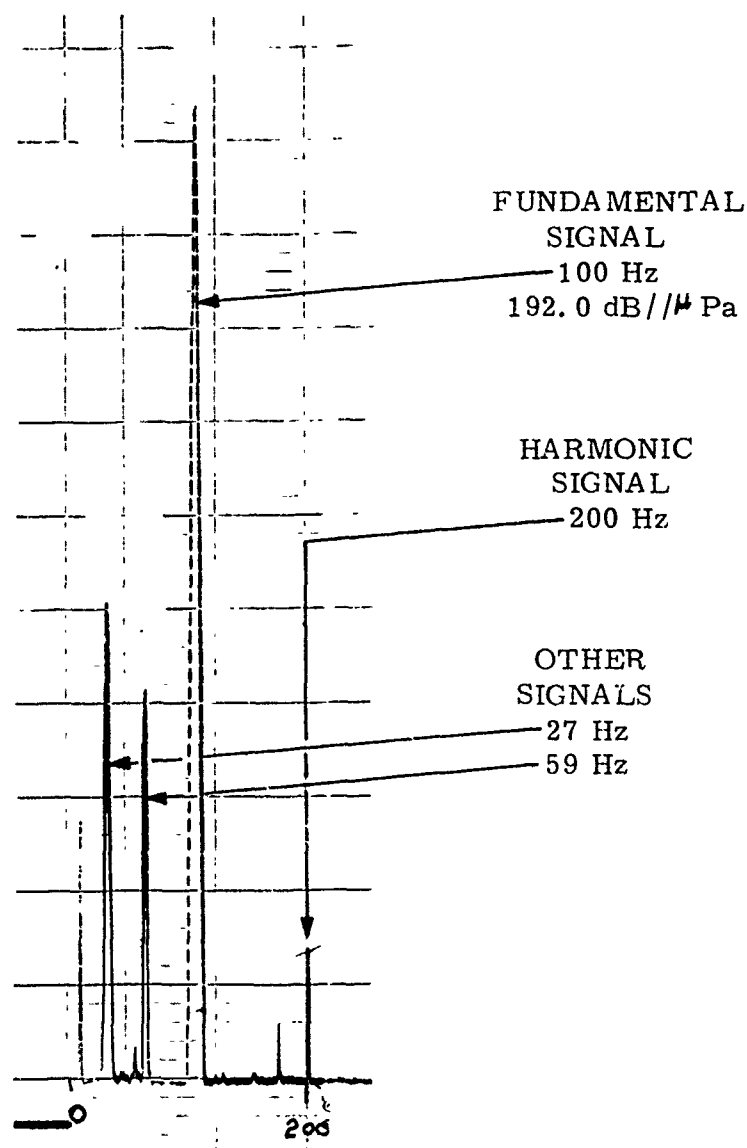


FREQUENCY
152138Z SEPT 1973

SHALLOW SOURCE
FIGURE 82

CONFIDENTIAL

EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
152146Z SEPT 1973

SHALLOW SOURCE

FIGURE 83
III-129

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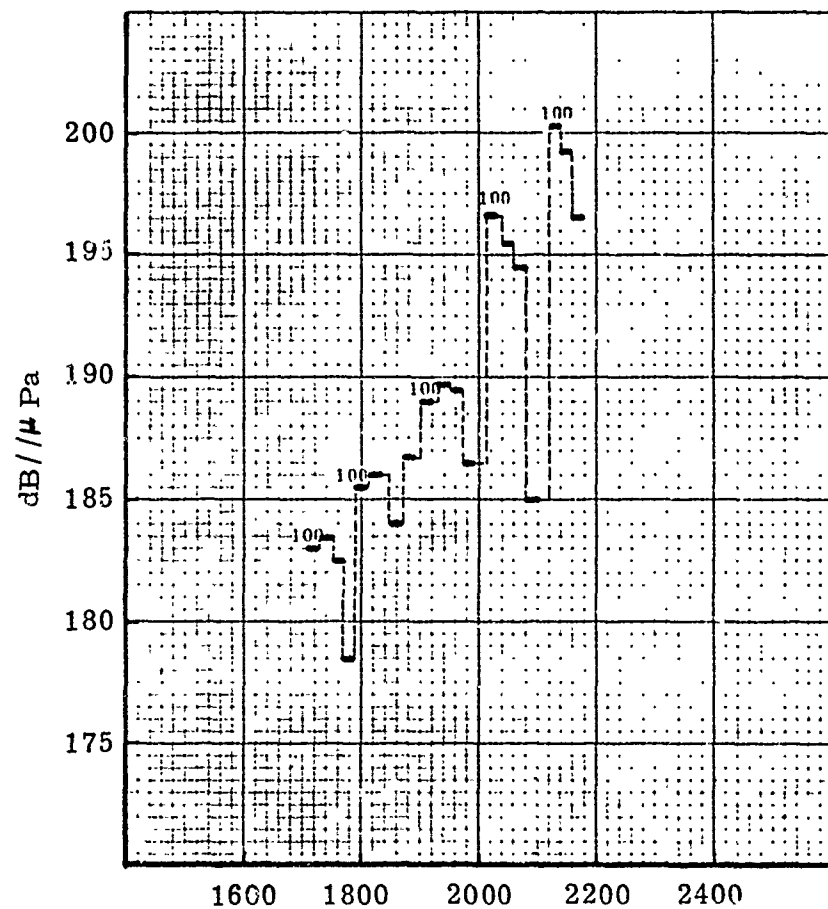
TABLE 38
EVENT MS 031'
POWER CYCLE

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
151700 to 151708	100	183	130	One minute 24 seconds late on turning OFF
151715 to 151723	38	184	130	
151730 to 151738	23	182	130	
151745 to 151755	11	173	130	
151800 to 151808	100	185	130	
151815 to 151823	38	186	130	
151830 to 151838	23	184	130	
151845 to 151853	11	187	130	
151900 to 151908	100	189	130	Ten seconds late turning OFF
151915 to 151923	38	190	130	
151930 to 151938	23	190	130	
151945 to 151953	11	186	129	
152000 to 152008	100	197	129	
152015 to 152023	38	195	130	
152030 to 152038	23	195	132	
152045 to 152053	11	185	132	
152100 to 152108	100	200	132	Three minutes late starting - hydraulic problems
152118 to 152123	38	199	132	
152130 to 152138	23	197	132	
152145 to 152153	11		133	

CONFIDENTIAL

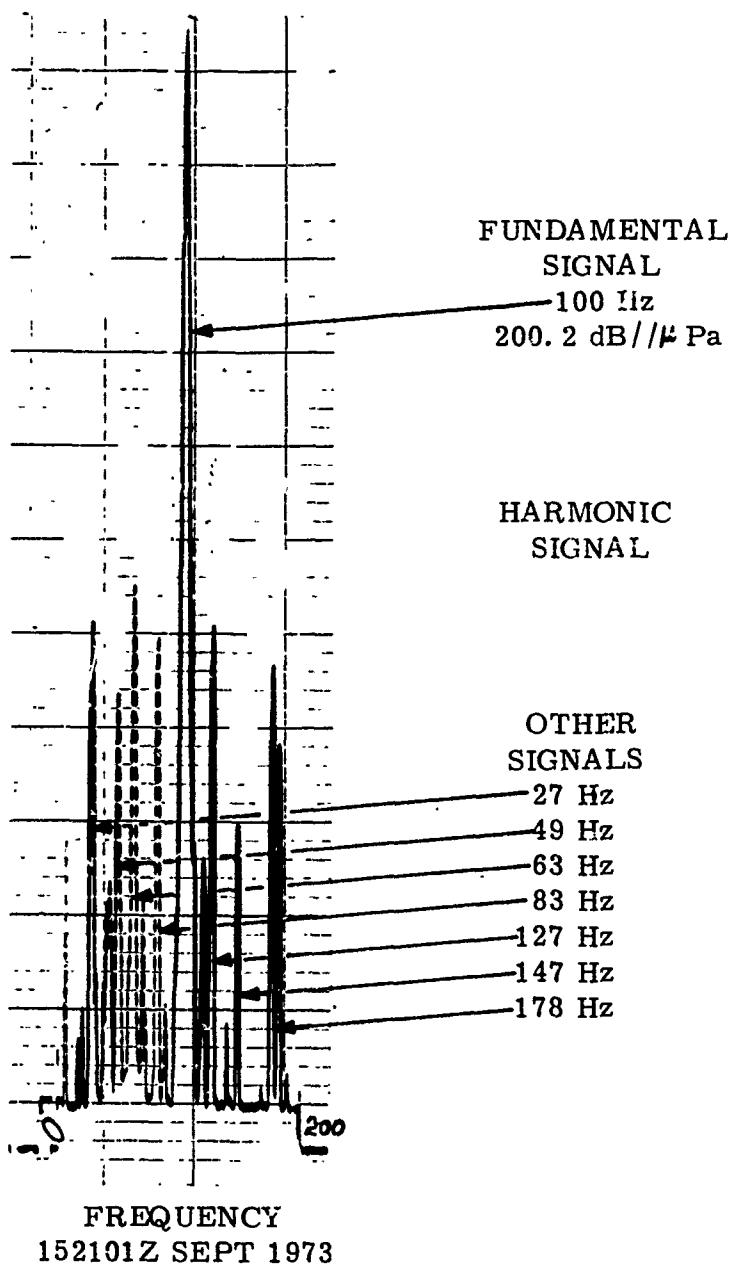
EVENT MS 031'
POWER CYCLE
DEEP SOURCE
100, 38, 23, & 11 Hz



TIME
GMT 15 Sept 1973
FIGURE 84

CONFIDENTIAL

EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



DEEP SOURCE

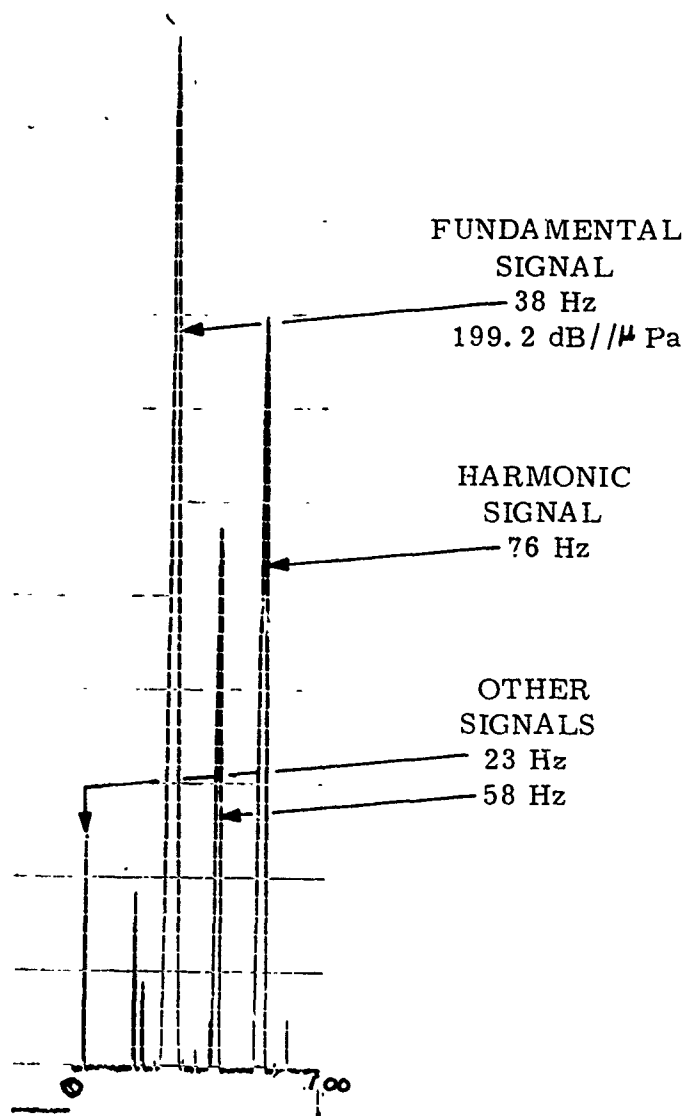
FIGURE 85

III-132

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EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
152122Z SEPT 1973

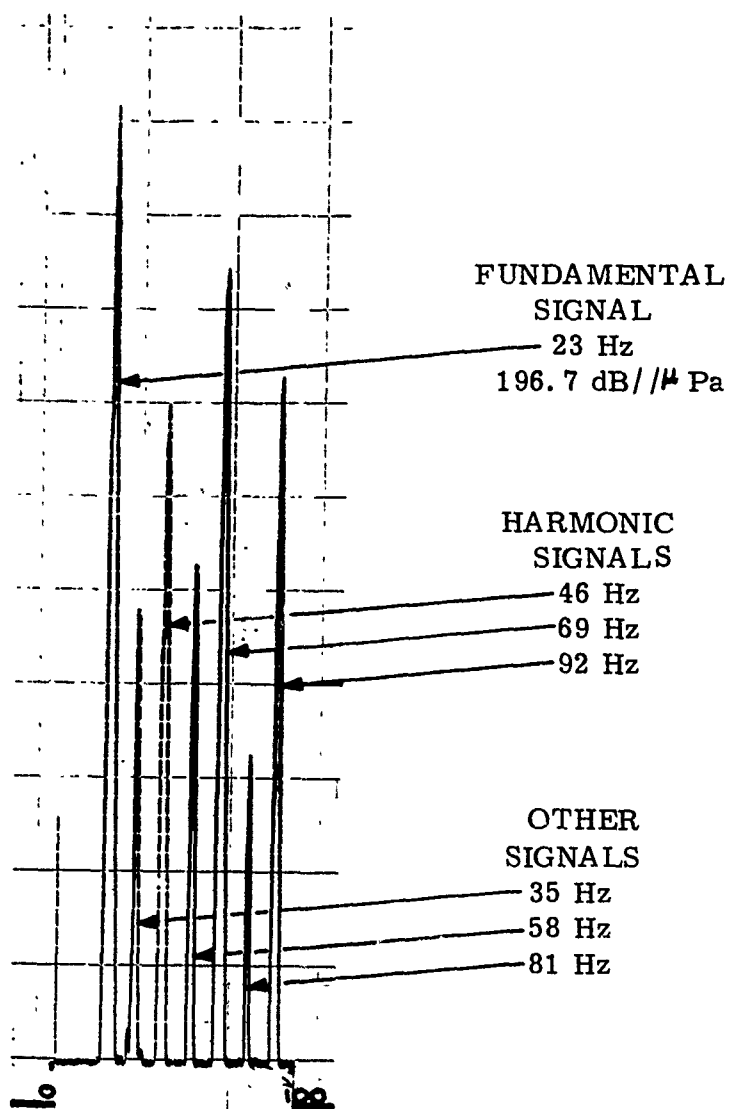
DEEP SOURCE
FIGURE 86

III-133

CONFIDENTIAL

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EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



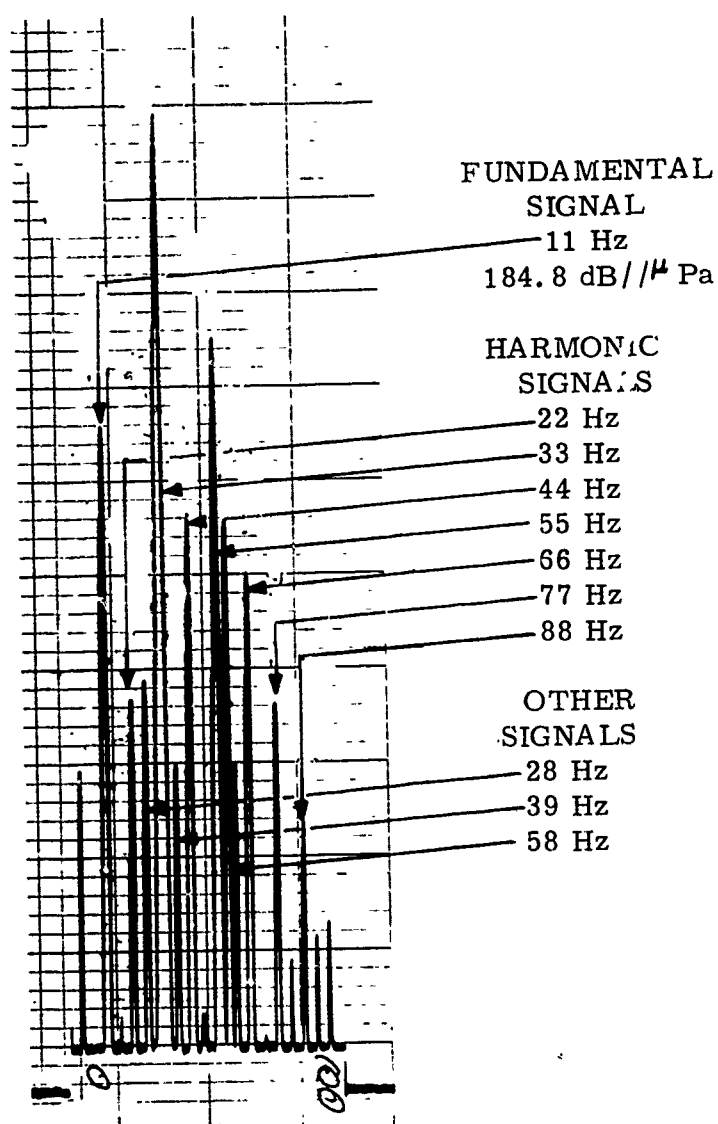
FREQUENCY
152134Z SEPT 1973

DEEP SOURCE
FIGURE 87
III-134

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CONFIDENTIAL

EVENT MS 031'
POWER CYCLE
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 19)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
152050Z SEPT 1973

DEEP SOURCE
FIGURE 88

III-135

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TABLE 39
EVENT MS 031'
POWER CYCLE
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
151700	DR	40° 01.4'	146° 20.4'
151800	DR	40° 01.2'	146° 21.3'
151900	F	40° 01.1'	146° 23.8'
152000	DR	39° 59.4'	146° 26.3'
152100	F	39° 59.4'	146° 28.3'
152145	F	39° 58.9'	146° 29.0'

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EVENT MS 031'

DEPTH CYCLE UP

(Stationary Transmission)

(Data Analysis Plan Experiment Number 18)

Schedule

Deep Source
171600Z Sept to 171651Z Sep
38 Hz, 8 minutes ON/7 minutes OFF
at constant power level and varying depth

Summary

The event was terminated because transmission was being made during an ambient noise (quiet period) day. Only three 8 minute transmissions were made at two different depths.

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TABLE 40

EVENT MS 031'

DEPTH CYCLE UP

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
171600 to 171608	38	194	133	Transmission was terminated because time period was an ambient (quiet period) noise day
171615 to 171623	38	194	132	
171645 to 171651	38	194	128	

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EVENT MS 031'
DEPTH CYCLE UP
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING

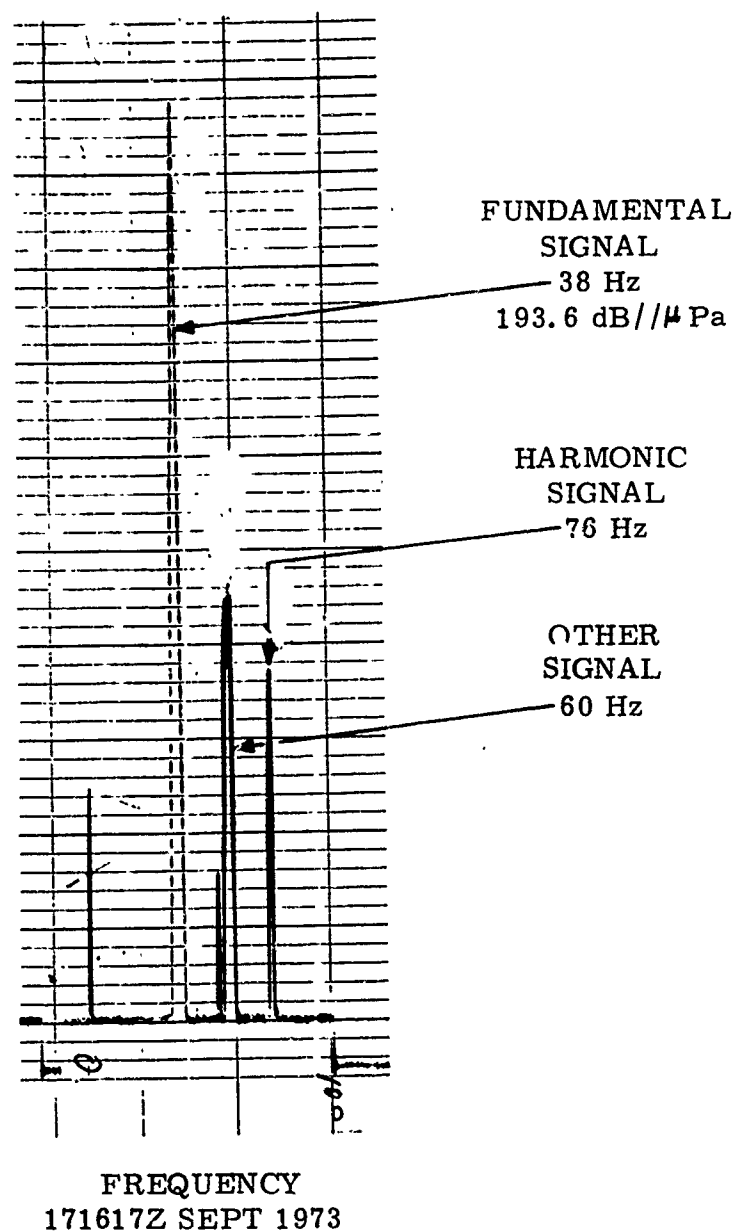


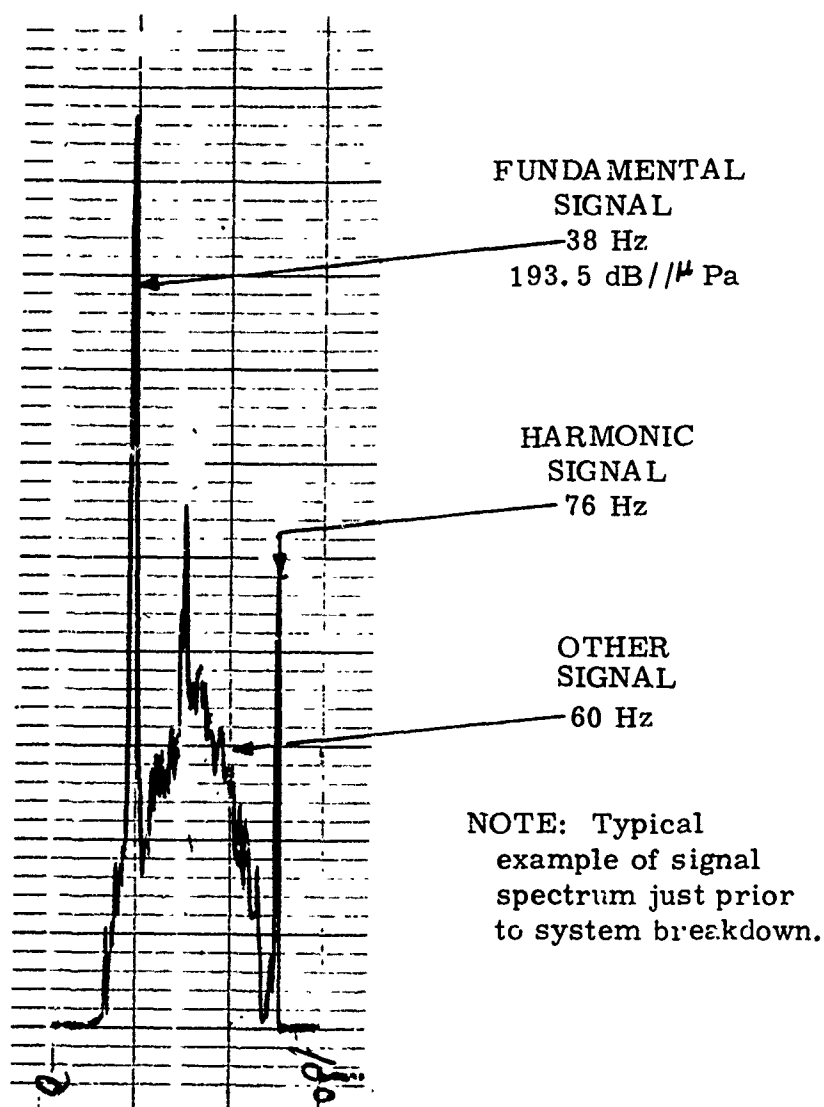
FIGURE 89
III-139

DEEP SOURCE
132 METER DEPTH

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EVENT MS 031'
DEPTH CYCLE UP
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 18)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
171648Z SEPT 1973

DEEP SOURCE
127 METER DEPTH

FIGURE 90

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TABLE 41
EVENT MS 031'
DEPTH CYCLE UP
TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
171600	DR	38° 31.1'	145° 57.2'

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EVENT MS 036

K-A TOW

(Data Analysis Plan Experiment Number 21)

Schedule

Shallow Source (Starboard)
160530Z Sept to 161545Z Sept
23, 38, 100 Hz, 5 minutes ON each
frequency at constant power level repeated
every 15 minutes with a quiet period the
last quarter hour each hour

Summary

The overall average transmission power
level of the source was 193 ± 2 dB/ μ Pa.
The 23 and 38 Hz transmissions were
 193 ± 1 dB/ μ Pa and the 100 Hz transmission
was at 192 ± 1 dB/ μ Pa. Depth was maintained
at 18 meters. The deep source was supposed
to be used but it was not operational due to
equipment problems.

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TABLE 42
EVENT MS 036
K-A TOW

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
160530 to 160535	23	195	18	
160535 to 160540	38	193	18	
160540 to 160545	100	194	18	
160600 to 160605	23	194	18	
160605 to 160610	38	194	18	
160610 to 160615	100	192	18	
160615 to 160620	23	193	18	
160620 to 160625	38	194	18	
160625 to 160630	100	192	18	
160630 to 160635	23	193	18	
160635 to 160640	38	194	18	
160640 to 160645	100	192	18	
160700 to 160705	23	193	18	
160705 to 160710	38	194	18	
160710 to 160715	100	193	18	
160715 to 160720	23	194	18	
160720 to 160725	38	194	18	
160725 to 160730	100	192	18	
160730 to 160735	23	193	18	
160735 to 160740	38	194	18	
160740 to 160745	100	192	18	
160800 to 160805	23	194	18	
160805 to 160810	38	194	18	
160810 to 160815	100	191	18	
160815 to 160820	23	193	18	
160820 to 160825	38	194	18	
160825 to 160830	100	191	18	
160830 to 160835	23	194	18	
160835 to 160840	38	194	18	
160840 to 160845	100	192	18	
160900 to 160905	23	193	18	
160905 to 160910	38	193	18	
160910 to 160915	100	192	18	
160915 to 160920	23	193	18	
160920 to 160925	38	194	18	
160925 to 160930	100	191	18	
160930 to 160935	23	194	18	
160935 to 160940	38	192	18	

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TABLE 42 (Continued)

EVENT MS 036

K-A TOW

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
160940 to 160945	100	192	18	
161000 to 161005	23	193	18	
161005 to 161010	38	192	18	
161010 to 161015	100	192	18	
161015 to 161020	23	193	18	
161020 to 161025	38	194	18	
161025 to 161030	100	192	18	
161030 to 161035	23	193	18	
161035 to 161040	38	194	18	
161040 to 161045	100	192	18	
161100 to 161105	23	193	18	
161105 to 161110	38	191	18	
161110 to 161115	100	192	18	
161115 to 161120	23	193	18	
161120 to 161125	38	191	18	
161125 to 161130	100	192	18	
161130 to 161135	23	193	18	
161135 to 161140	38	192	18	
161140 to 161145	100	190	18	
161200 to 161205	23	193	18	
161205 to 161210	38	192	18	
161210 to 161215	100	192	18	
161215 to 161220	23	193	18	
161220 to 161225	38	192	18	
161225 to 161230	100	192	18	
161230 to 161235	23	193	18	
161235 to 161240	38	194	18	
161240 to 161245	100	192	18	
161300 to 161305	23	193	18	
161305 to 161310	38	190	18	
161310 to 161315	100	192	18	
161315 to 161320	23	192	18	
161320 to 161325	38	191	18	
161325 to 161330	100	192	18	
161330 to 161335	23	193	18	
161335 to 161340	38	193	18	
161340 to 161345	100	192	18	

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TABLE 42 (Continued)

EVENT MS 036

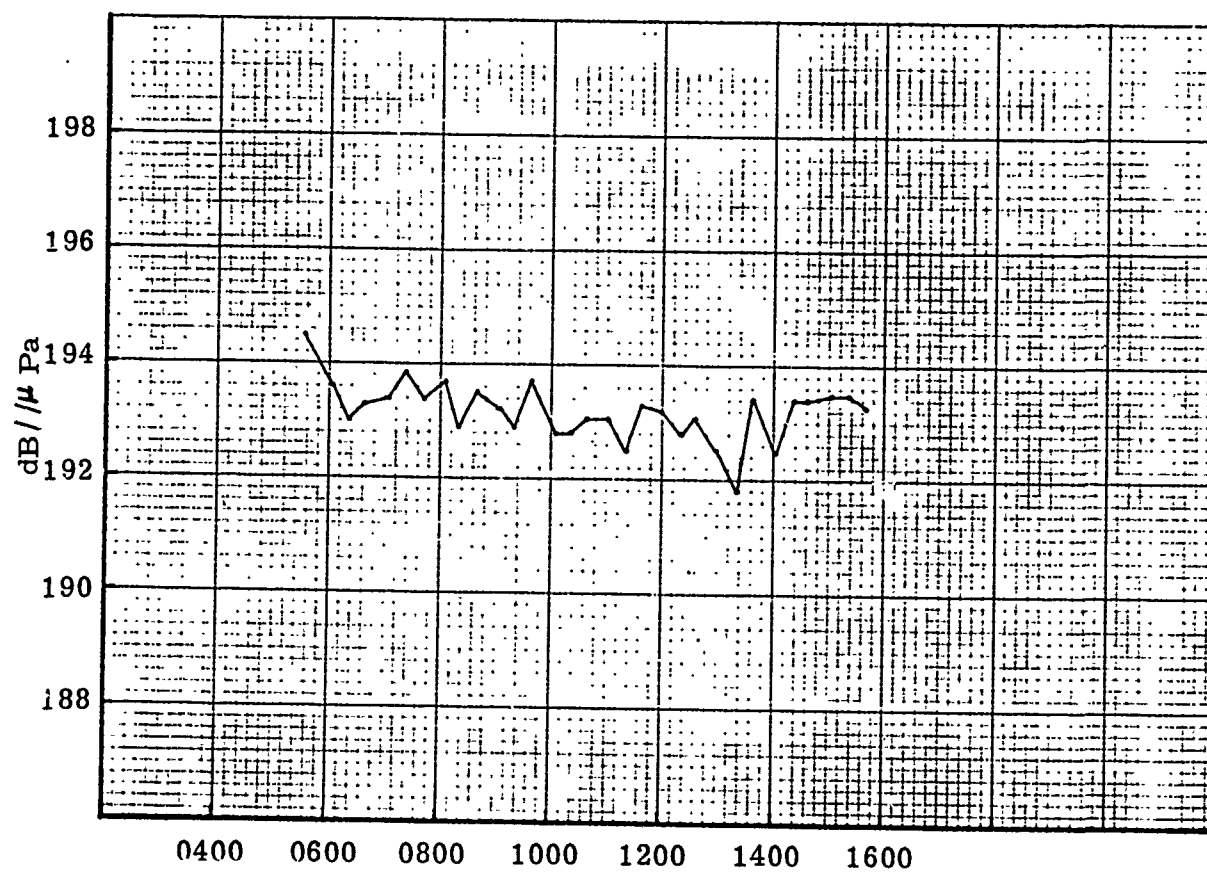
K-A TOW

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
161400 to 161405	23	193	18	
161405 to 161410	38	193	18	
161410 to 161415	100	191	18	
161415 to 161420	23	193	18	
161420 to 161425	38	189	18	
161425 to 161430	100	190	18	
161430 to 161435	23	193	18	
161435 to 161440	38	191	18	
161440 to 161445	100	192	18	
161500 to 161505	23	194	18	
161505 to 161510	38	191	18	
161510 to 161515	100	192	18	
161515 to 161520	23	194	18	
161520 to 161525	38	194	18	
161525 to 161530	100	192	18	
161530 to 161535	23	193	18	
161535 to 161540	38	191	18	
161540 to 161545	100	190	18	

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EVENT MS 036
K - A TOW
SHALLOW SOURCE
23 Hz



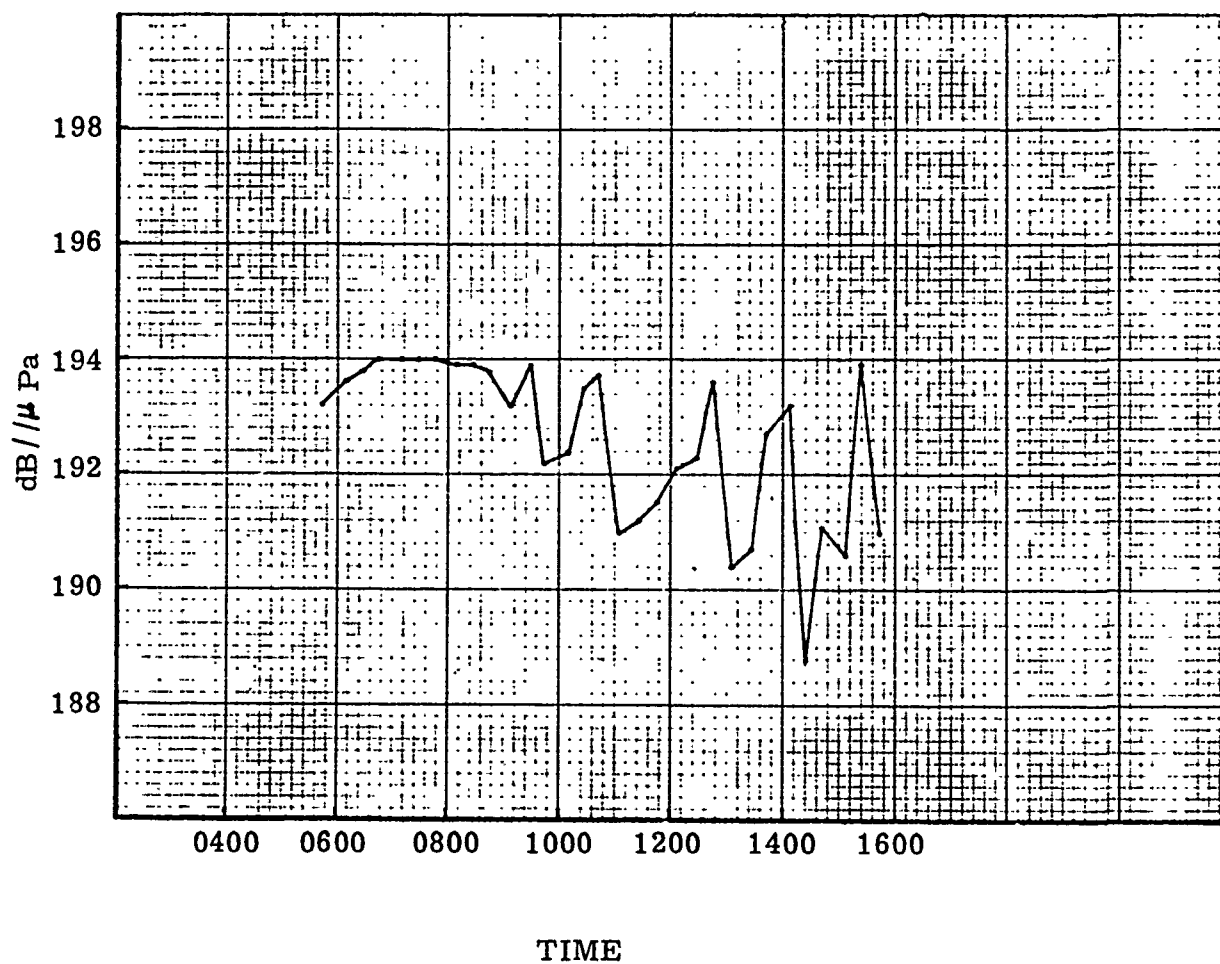
TIME
GMT 16 Sept 1973

FIGURE 91

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EVENT MS 036
K - A TOW
SHALLOW SOURCE
38 Hz



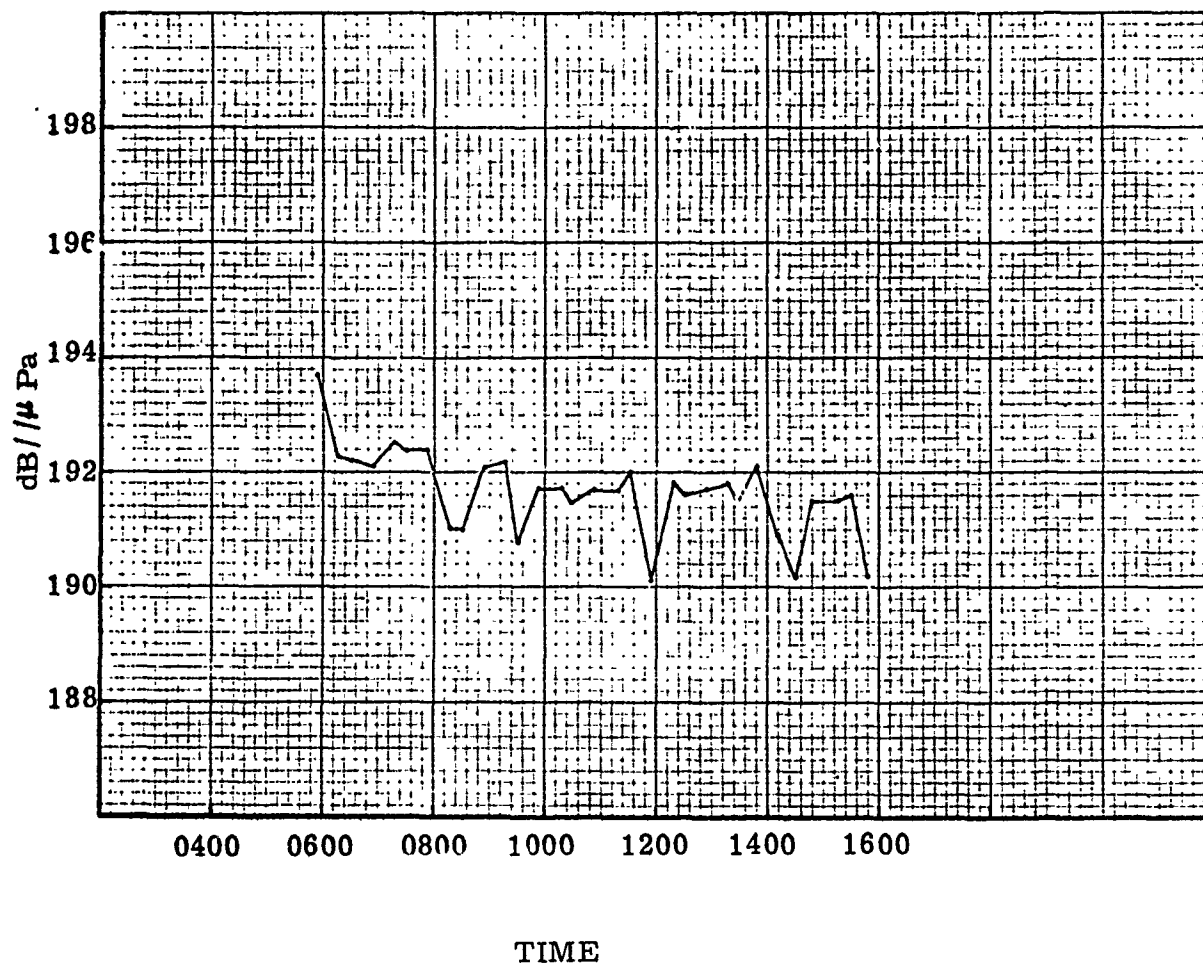
GMT 16 Sept 1973

FIGURE 92

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EVENT MS 036
K - A TOW
SHALLOW SOURCE
100 Hz



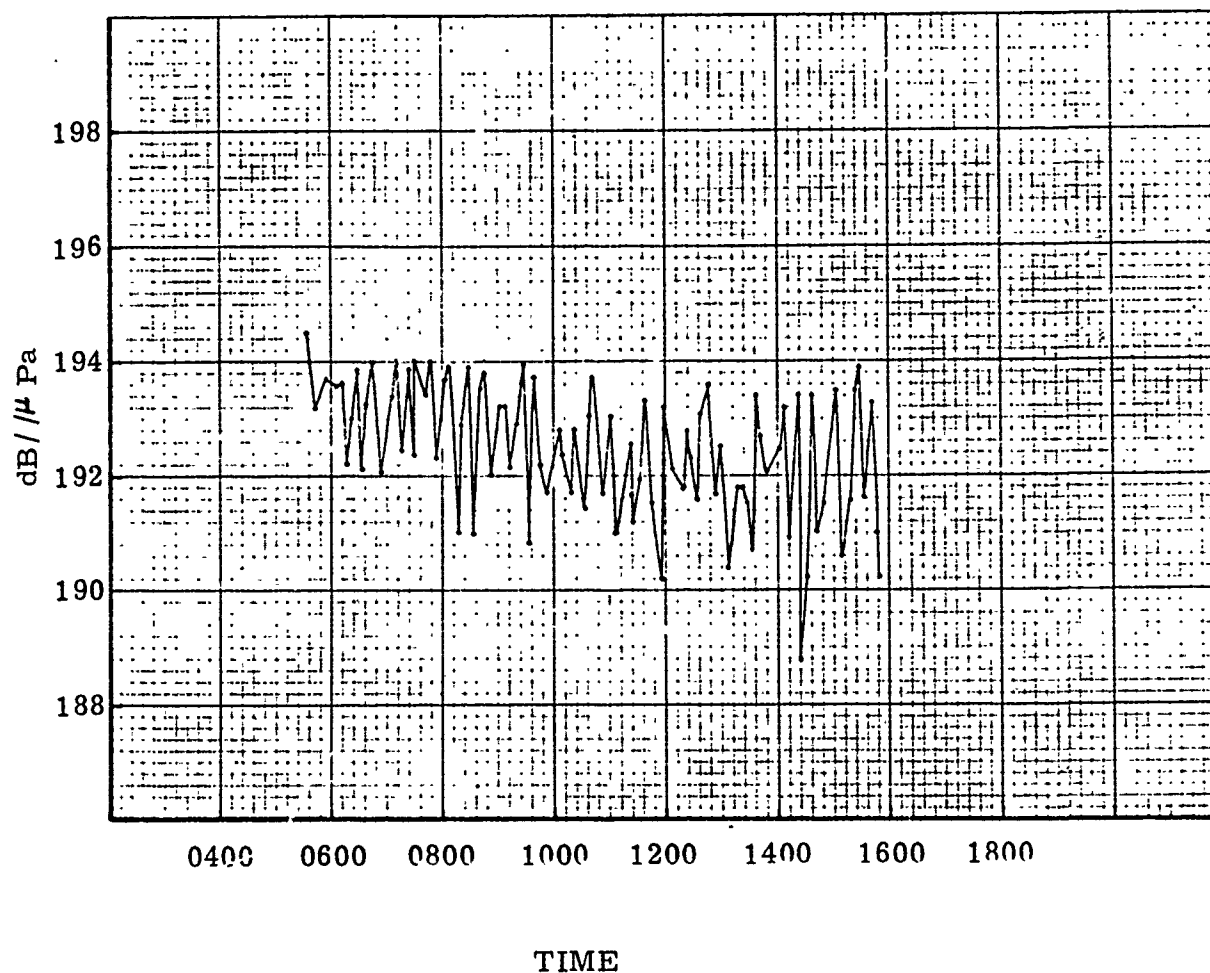
GMT 16 Sept 1973

FIGURE 93

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EVENT MS 036
K - A TOW
SHALLOW SOURCE
23, 38, 100, Hz



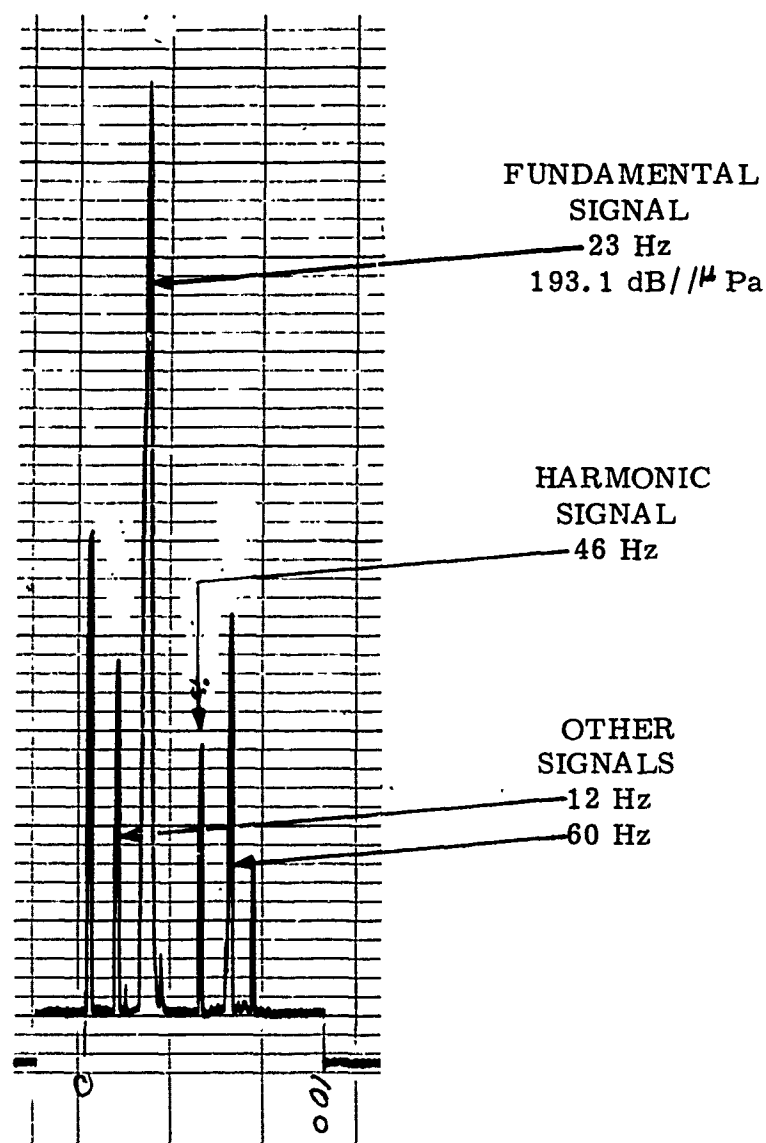
GMT 16 Sept 1973

FIGURE 94

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EVENT MS 036
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 21)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
161231Z SEPT 1973

SHALLOW SOURCE

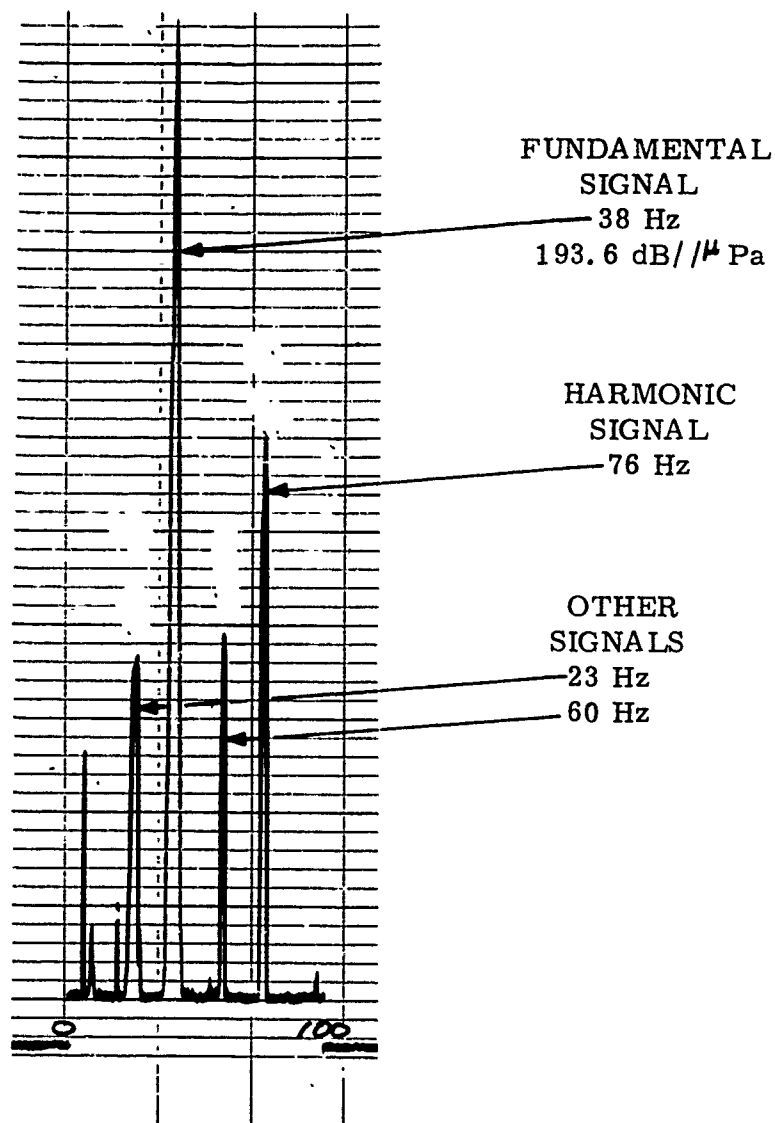
FIGURE 95

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EVENT MS 036
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 21)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
161235Z SEPT 1973

SHALLOW SOURCE

FIGURE 96

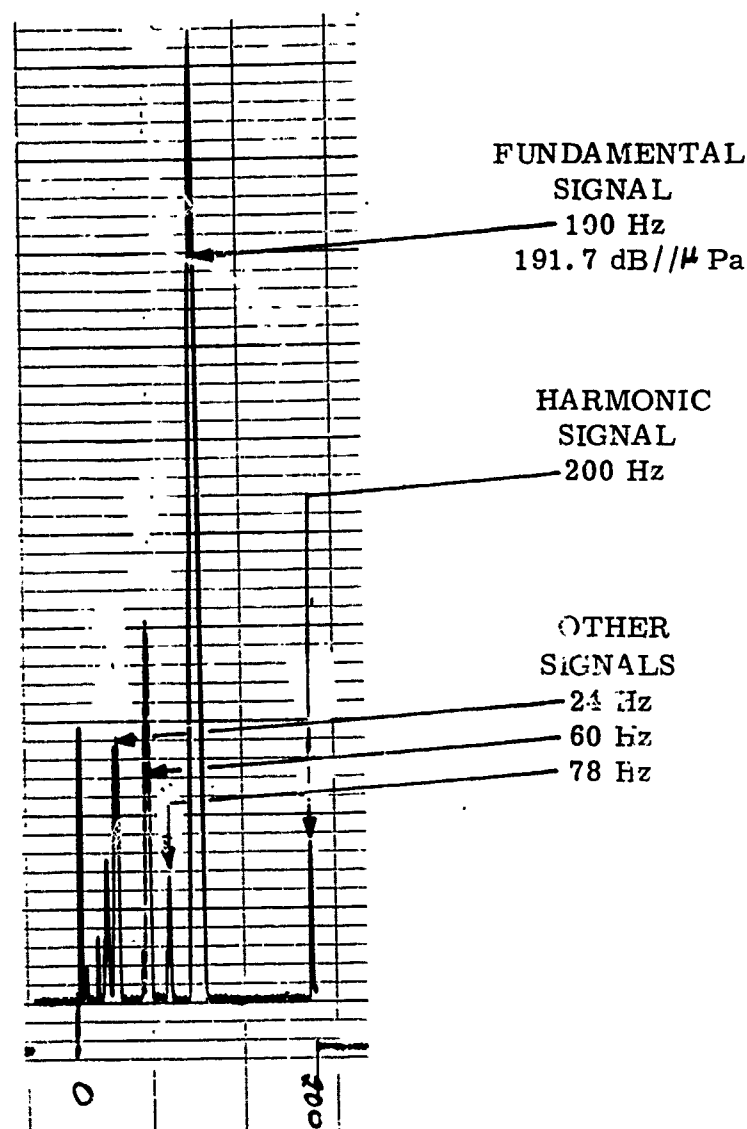
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EVENT MS 036
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 21)

SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
161241Z SEPT 1973

SHALLOW SOURCE

FIGURE 97

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TABLE 43

EVENT MS 036

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
160530	DR	40° 01.5'	146° 26.1'
160646	F	39° 56.5'	146° 21.4'
160745	DR	39° 53.4'	146° 19.7'
160910	DR	39° 47.4'	146° 16.6'
161030	F	39° 39.7'	146° 15.5'
161200	DR	39° 33.4'	146° 14.3'
161304	DR	39° 27.8'	146° 13.4'
161424	F	39° 18.2'	146° 12.3'
161545	DR	39° 16.6'	146° 11.0'

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EVENT MS 037

K-A STATIC

(Data Analysis Plan Experiment Number 22)

Schedule

Shallow Source (Starboard)
161600Z Sept to 162115Z Sept
45 minutes ON at 100 Hz and 90 minutes
ON at 38 Hz at constant power level

Summary

Source transmission was relatively constant
at 192 ± 1 dB/ μ Pa. Deep source was inoperable
due to equipment problems.

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TABLE 44

EVENT MS 037

K-A STATIC

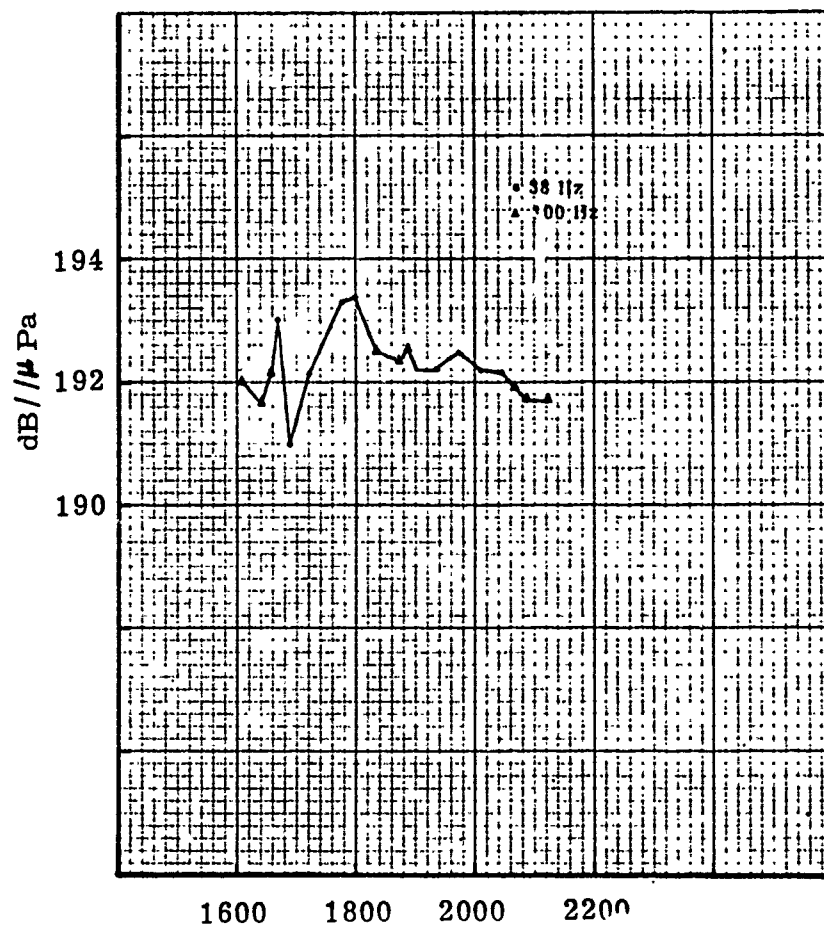
SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
161600 to 161645	100	192	18	
161645 to 161815	38	193	18	
161815 to 161930	100	192	18	
161900 to 162030	38	192	18	
162030 to 162115	100	191	18	

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EVENT MS 037
K-A STATIC
SHALLOW SOURCE
38 & 100 Hz



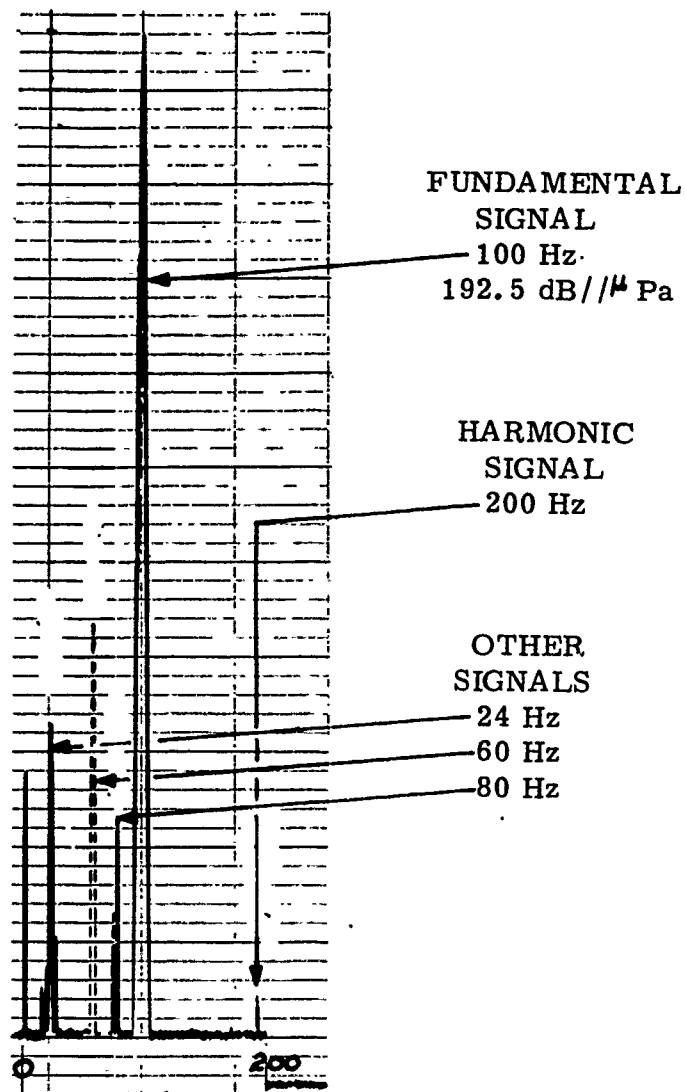
TIME
GMT 16 Sept 1973

FIGURE 98

CONFIDENTIAL

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EVENT MS 037
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 22)
SAMPLE SIGNAL SPECTRUM RECORDING



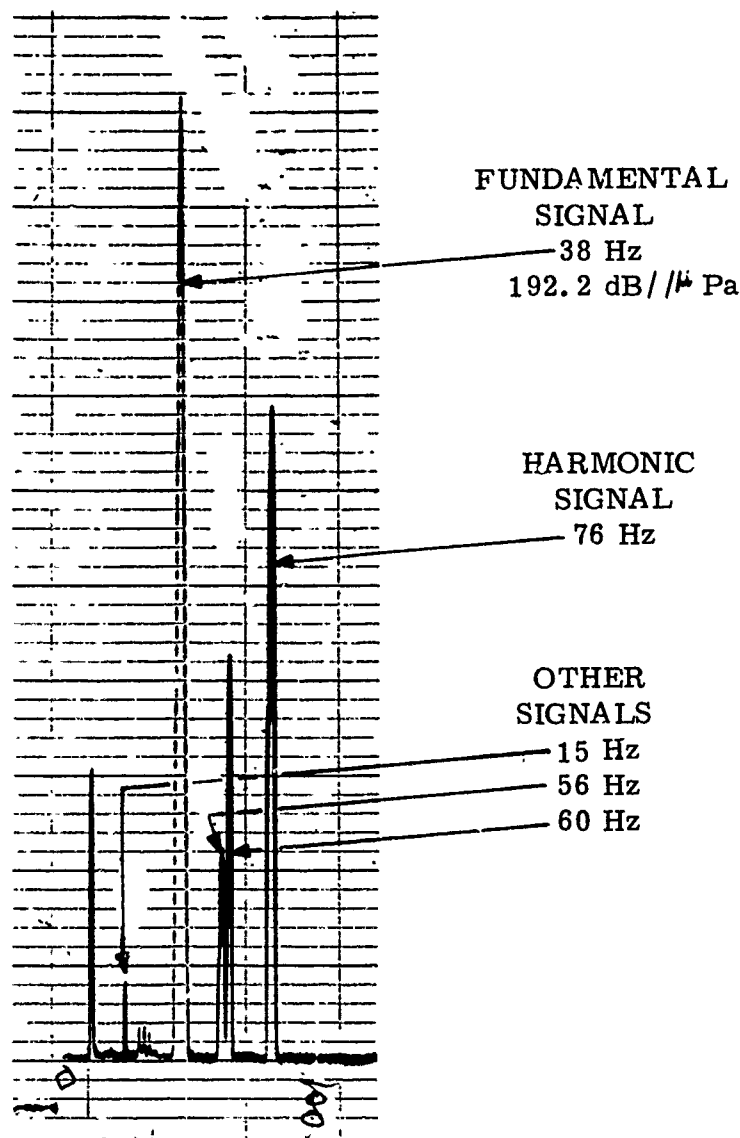
FREQUENCY
161845Z SEPT 1973

SHALLOW SOURCE
FIGURE 99

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EVENT MS 037
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 22)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
161923Z SEPT 1973

SHALLOW SOURCE
FIGURE 100

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TABLE 45

EVENT MS 037

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
161610	F	39° 15. 2'	146° 12. 4'
161640	F	39° 15. 4'	146° 12. 5'
161832	F	39° 16. 2'	146° 13. 4'
162030	DR	39° 17. 3'	146° 12. 0'

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EVENT MS 038

K-A TOW

(Data Analysis Plan Experiment Number 23)

Schedule

Shallow Source (Starboard)

162300Z Sept to 170945Z Sept

23, 38, 100 Hz, 5 minutes ON each frequency at a constant power level repeated every 15 minutes with a quiet period the last quarter hour each hour

Deep Source

162300Z Sept to 170945Z Sept

11 Hz, 45 minutes ON at the start of every odd numbered hour, 100, 23, 38 Hz, 5 minutes each frequency repeated every 15 minutes for the first 45 minutes of every even numbered hour at constant power level

Summary

The shallow source transmissions were relatively constant. The 23 Hz transmissions average 194 ± 1 dB/ μ Pa. The 38 Hz at 193 ± 1 dB/ μ Pa, and the 100 Hz at 190 ± 1 dB/ μ Pa. Depth was maintained at 19 meters ± 1 meter. The deep source transmission was not steady. The 11 Hz transmission was at 185 ± 1 dB/ μ Pa, 100 Hz at 198 ± 1 dB/ μ Pa, 23 Hz at 200 ± 2 dB/ μ Pa and 38 Hz at 200 ± 1 dB/ μ Pa. Depth level was maintained at 105 meters ± 5 meters. Spectrum readings of both shallow and deep source indicate a relatively clean transmission.

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TABLE 46

EVENT MS 038

K-A TOW

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
162300 to 162305	23	.	18	
162305 to 162310	38	193	18	
162310 to 162315	100	190	18	
162315 to 162320	23		18	
162320 to 162325	38	193	18	
162325 to 162330	100	190	18	
162330 to 162335	23		18	
162335 to 162340	38	191	18	
162340 to 162345	100		18	
170000 to 170005	23	193	18	
170005 to 170010	38		18	
170010 to 170015	100	190	18	
170015 to 170020	23	194	18	
170020 to 170025	38		18	
170025 to 170030	100		18	
170030 to 170035	23	194	18	
170035 to 170040	38	197	18	
170040 to 170045	100	190	18	
170100 to 170105	23	193	18	
170105 to 170110	38	191	18	
170110 to 170115	100	190	18	
170115 to 170120	23		18	
170120 to 170125	38		18	
170125 to 170130	100		18	
170130 to 170135	23	193	18	
170135 to 170140	38	193	18	
170140 to 170145	100	191	18	
170200 to 170205	23		18	
170205 to 170210	38	193	18	
170210 to 170215	100	190	18	
170215 to 170220	23		18	
170220 to 170225	38	193	18	
170225 to 170230	100	190	18	
170230 to 170235	23	194	18	
170235 to 170240	38	193	18	
170240 to 170245	100	190	18	
170300 to 170305	23	194	18	

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TABLE 46 (Continued)

EVENT MS 038

K-A TOW

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
170305 to 170310	38		18	
170310 to 170315	100	191	18	
170315 to 170320	23	193	19	
170320 to 170325	38	192	19	
170325 to 170330	100	190	19	
170330 to 170335	23	194	19	
170335 to 170340	38		19	
170340 to 170345	100	190	19	
170400 to 170405	23		20	
170405 to 170410	38	193	20	
170410 to 170415	100	190	20	
170415 to 170420	23		20	
170420 to 170425	38	193	20	
170425 to 170430	100	190	20	
170430 to 170435	23	193	20	
170435 to 170440	38	193	20	
170440 to 170445	100		20	
170500 to 170505	23		19	
170505 to 170510	38	191	19	
170510 to 170515	100	190	19	
170515 to 170520	23	193	19	
170520 to 170525	38	193	19	
170525 to 170530	100	190	19	
170530 to 170535	23		19	
170535 to 170540	38	193	19	
170540 to 170545	100		19	
170600 to 170605	23	194	19	
170605 to 170610	38		19	
170610 to 170615	100		19	
170615 to 170620	23	194	19	
170620 to 170625	38	193	19	
170625 to 170630	100	191	19	
170630 to 170635	23		19	
170635 to 170640	38		19	
170640 to 170645	100	190	19	
170700 to 170705	23		19	
170705 to 170710	38	193	19	
170710 to 170715	100	191	19	

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TABLE 46 (Continued)

EVENT MS 038

K-A TOW

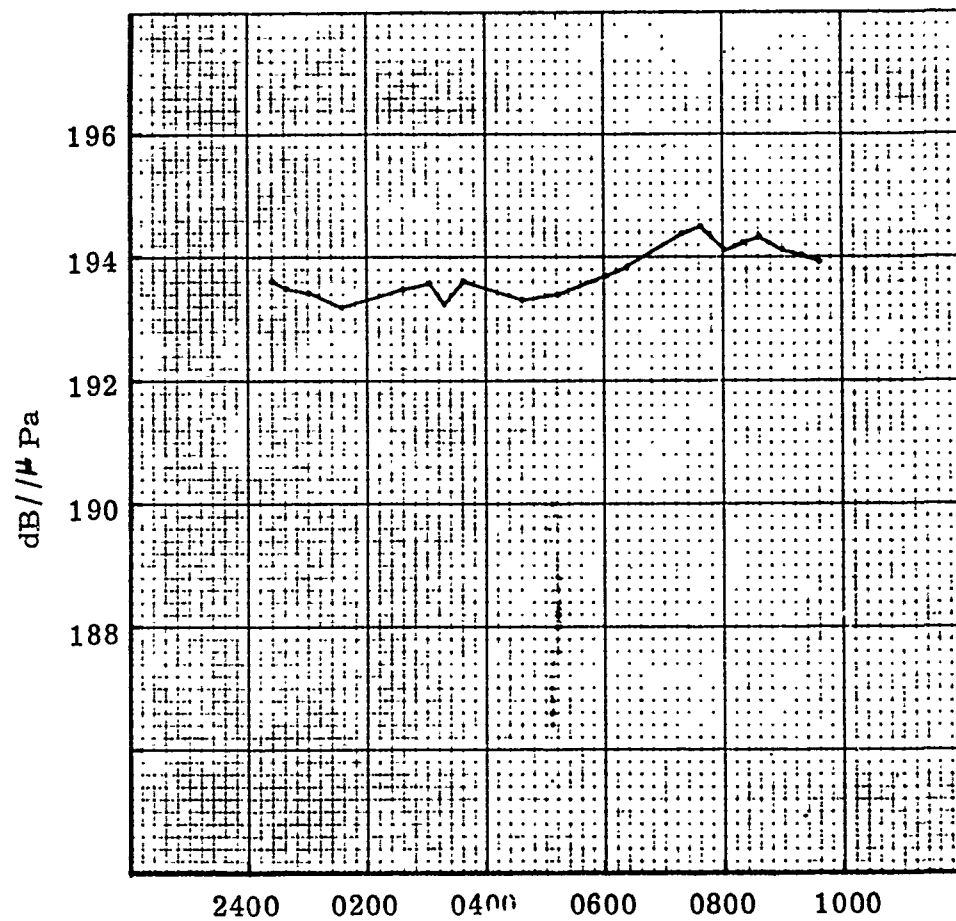
SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
170715 to 170720	23	194	19	
170720 to 170725	38	193	19	
170725 to 170730	100	191	19	
170730 to 170735	23	195	19	
170735 to 170740	38	193	19	
170740 to 170745	100	191	19	
170800 to 170805	23	194	19	
170805 to 170810	38	193	19	
170810 to 170815	100	190	19	
170815 to 170820	23	194	19	
170820 to 170825	38	193	19	
170825 to 170830	100	189	19	
170830 to 170835	23	194	19	
170835 to 170840	38	193		
170840 to 170845	100	191	19	
170900 to 170905	23	194	19	
170905 to 170910	38	193	19	
170910 to 170915	100	190	19	
170915 to 170920	23	194	19	
170920 to 170925	38	193	19	
170925 to 170930	100	191	19	
170930 to 170935	23	194	19	
170935 to 170940	38	193	19	
170940 to 170945	100	190	19	

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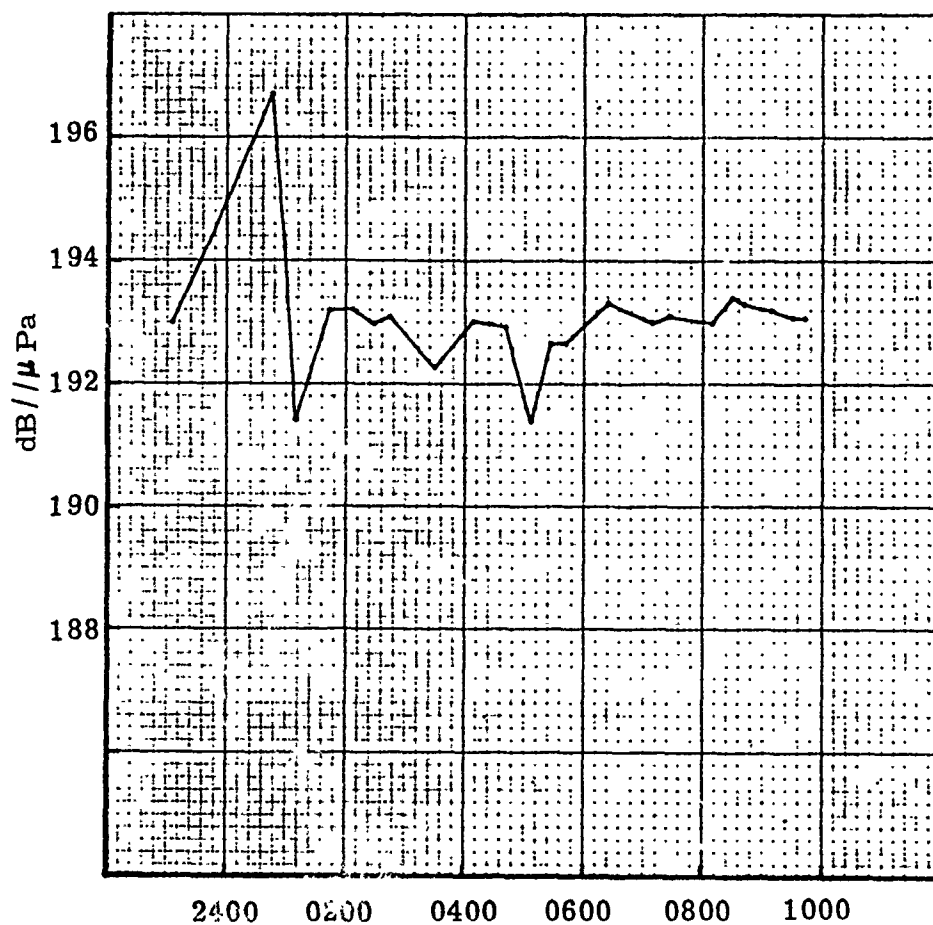
EVENT MS 038
K-A TOW
SHALLOW SOURCE
23 Hz



TIME
GMT 16 & 17 Sept 1973
FIGURE 101

CONFIDENTIAL

EVENT MS 038
K-A TOW
SHALLOW SOURCE
38 Hz

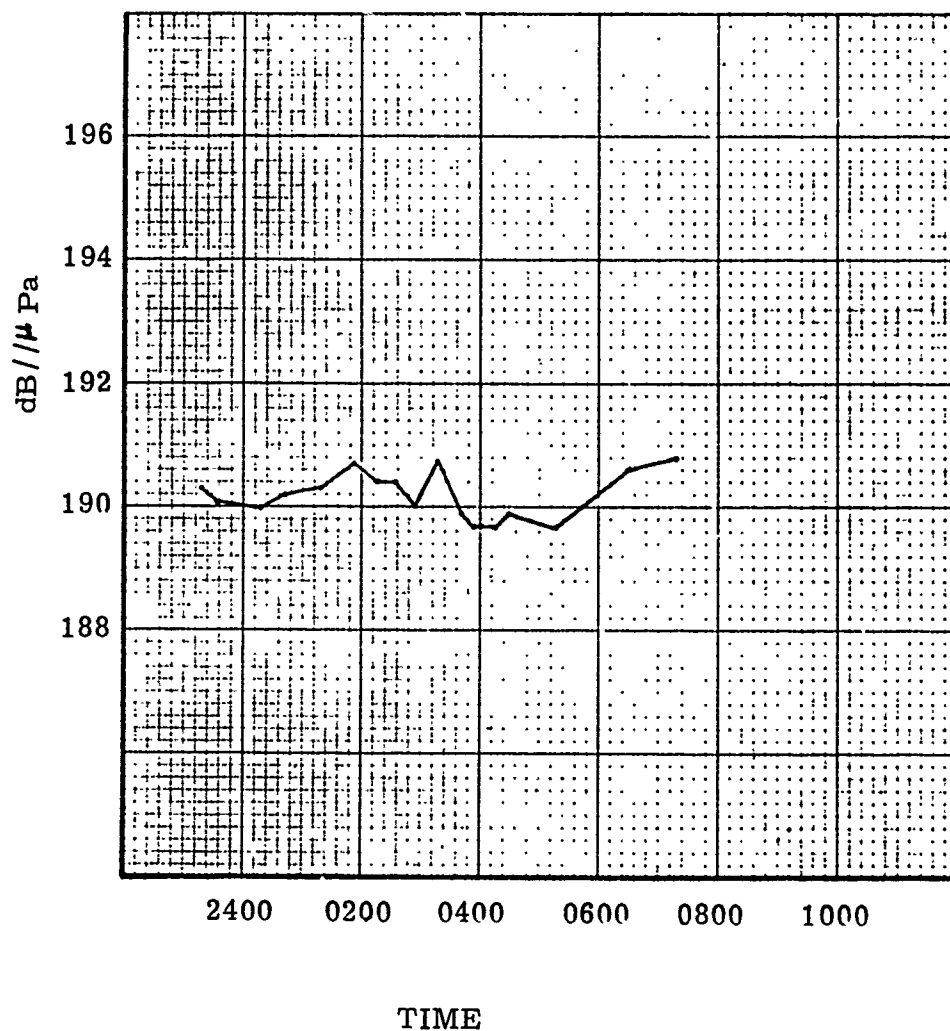


TIME
GMT 16 & 17 Sept 1973

FIGURE 102

CONFIDENTIAL

EVENT MS 038
K-A TOW
SHALLOW SOURCE
100 Hz



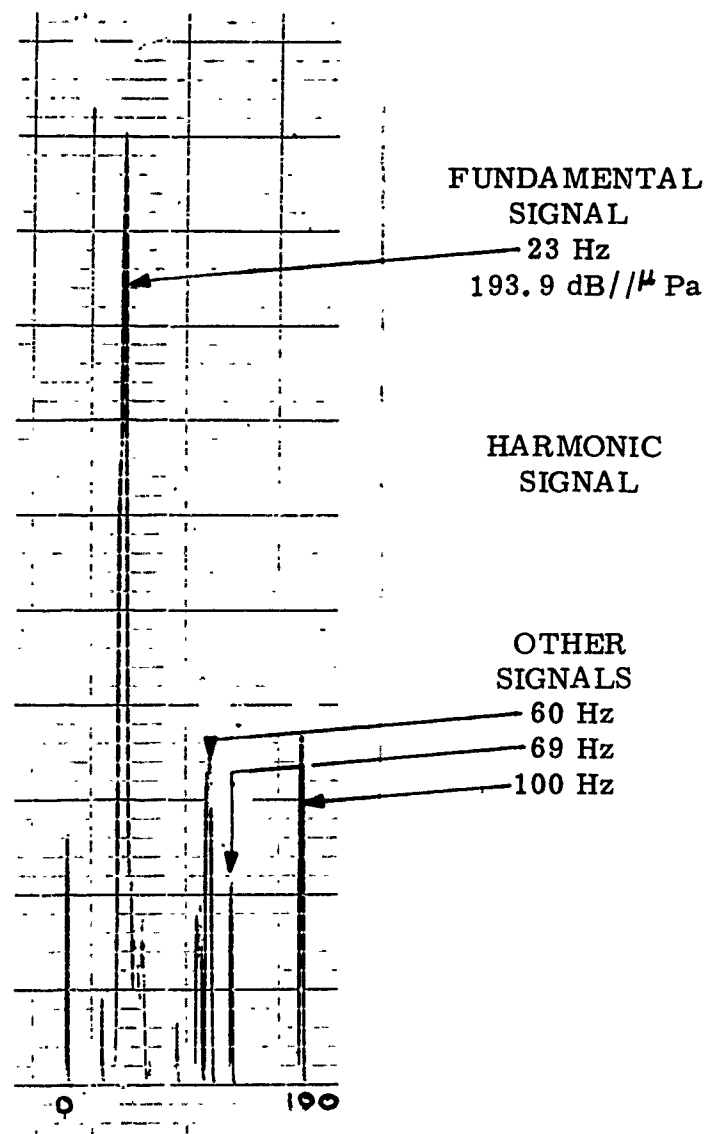
GMT 16 & 17 Sept 1973

FIGURE 103

CONFIDENTIAL

CONFIDENTIAL

EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
170932Z SEPT 1973

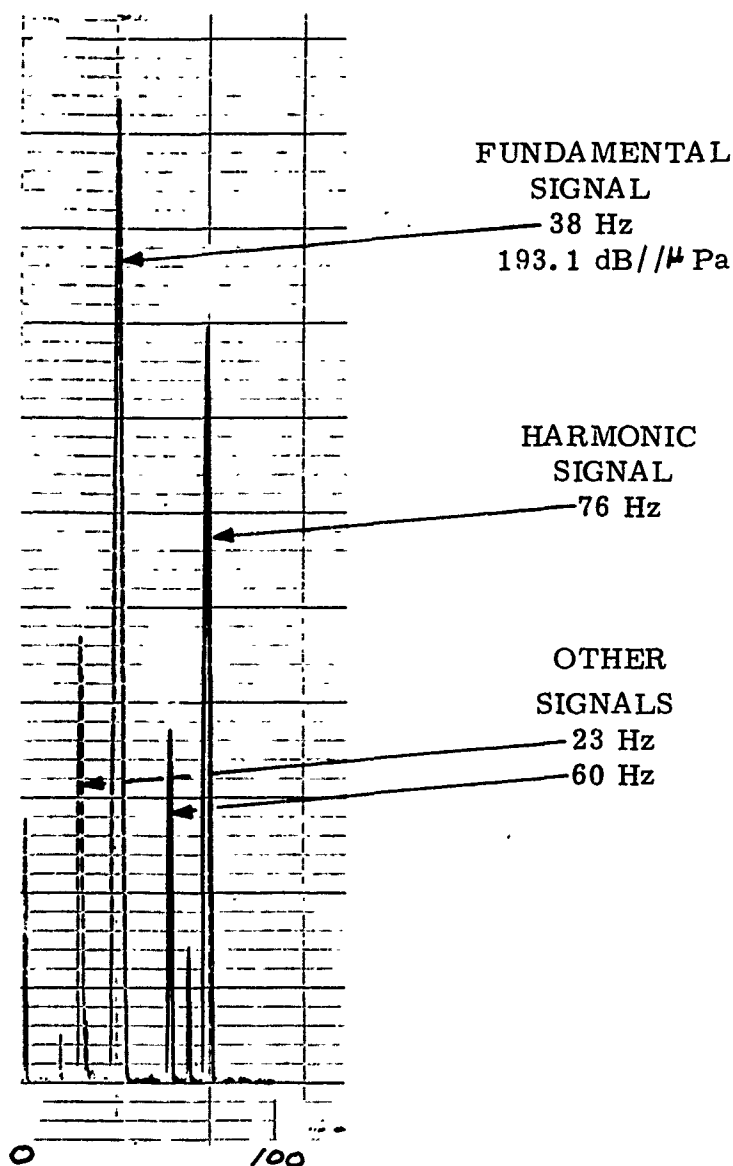
SHALLOW SOURCE
FIGURE 104

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CONFIDENTIAL

CONFIDENTIAL

EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)
SAMPLE SIGNAL SPECTRUM RECORDING

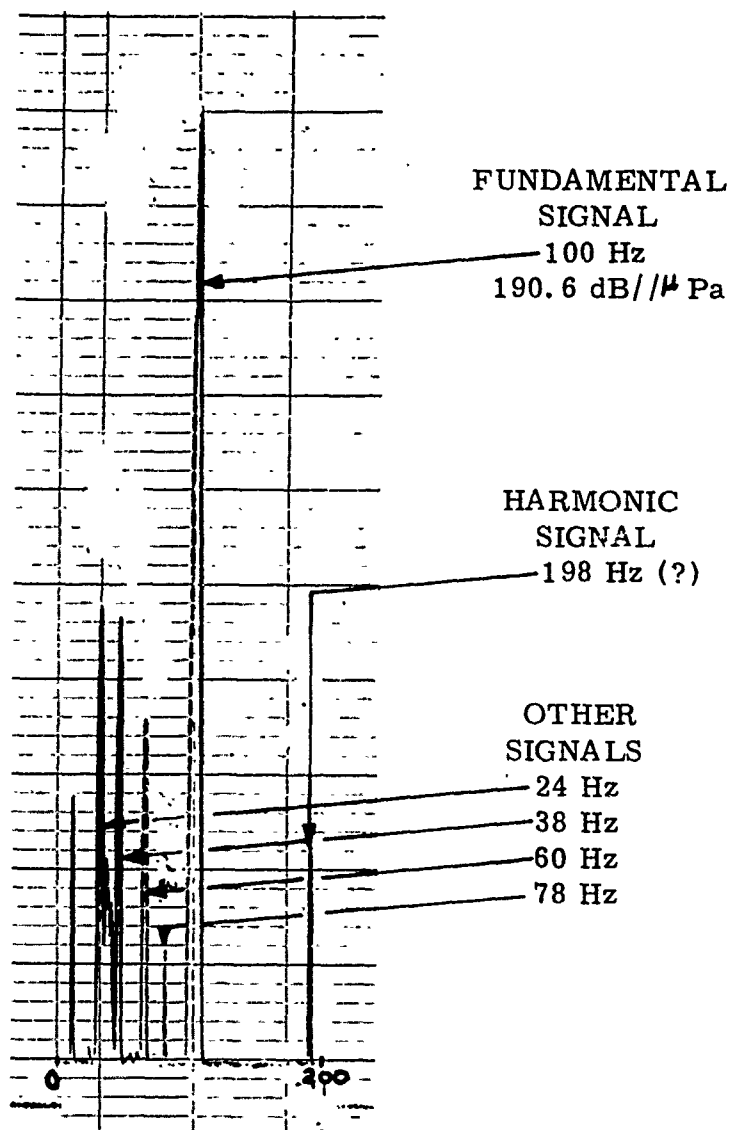


FREQUENCY
170923Z SEPT 1973

SHALLOW SOURCE
FIGURE 105

CONFIDENTIAL

EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
170626Z SEPT 1973

SHALLOW SOURCE
FIGURE 106

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TABLE 47

EVENT MS 038

K-A TOW

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
162300 to 162345	11	186	103	
170000 to 170005	100	195	103	
170005 to 170010	23	200	103	
170010 to 170015	38	199	103	
170015 to 170020	100	197	103	
170020 to 170025	23		103	
170025 to 170030	38	200	103	
170030 to 170035	100	199	103	
170035 to 170040	23	200	103	
170040 to 170045	38	200	101	
170100 to 170145	11	185	101	
170200 to 170205	100	199	101	
170205 to 170210	23		101	
170210 to 170215	38	200	101	
170215 to 170220	100	199	101	
170220 to 170225	23	200	101	
170225 to 170230	38		101	
170230 to 170235	100	199	101	
170235 to 170240	23	202	101	
170240 to 170245	38	200	101	
170300 to 170345	11	185	97	
170400 to 170405	100	199	108	
170405 to 170410	23		108	
170410 to 170415	38	200	108	
170415 to 170420	100	199	108	
170420 to 170425	23	198	108	
170425 to 170430	38		108	
170430 to 170435	100	198	108	
170435 to 170440	23		108	
170440 to 170445	38	200	108	
170500 to 170545	11	184	108	
170600 to 170605	100	198	108	
170605 to 170610	23	201	108	
170610 to 170615	38	201	108	
170615 to 170620	100		108	
170620 to 170625	23		108	
170625 to 170630	38		108	
170630 to 170635	100	199	103	

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TABLE 47 (Continued)

EVENT MS 038

K-A TOW

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
170635 to 170640	23	201	103	
170640 to 170645	38	201	103	
170700 to 170745	11	184	112	
170800 to 170805	100	200	115	
170805 to 170810	23	197	115	
170810 to 170815	38	200	100	
170815 to 170820	100	198	100	
170820 to 170825	23	199	100	
170825 to 170830	38	201	100	
170830 to 170835	100	195	100	
170835 to 170840	23	199	100	
170840 to 170845	38	201	100	
170900 to 170905	100	199	99	
170905 to 170910	23	202	99	
170910 to 170915	38	199	99	
170915 to 170920	100	196	99	
170920 to 170925	23	202	99	
170925 to 170930	38	201	99	
170930 to 170935	100	200	99	
170935 to 170940	23	202	99	
170940 to 170945	38	201	99	

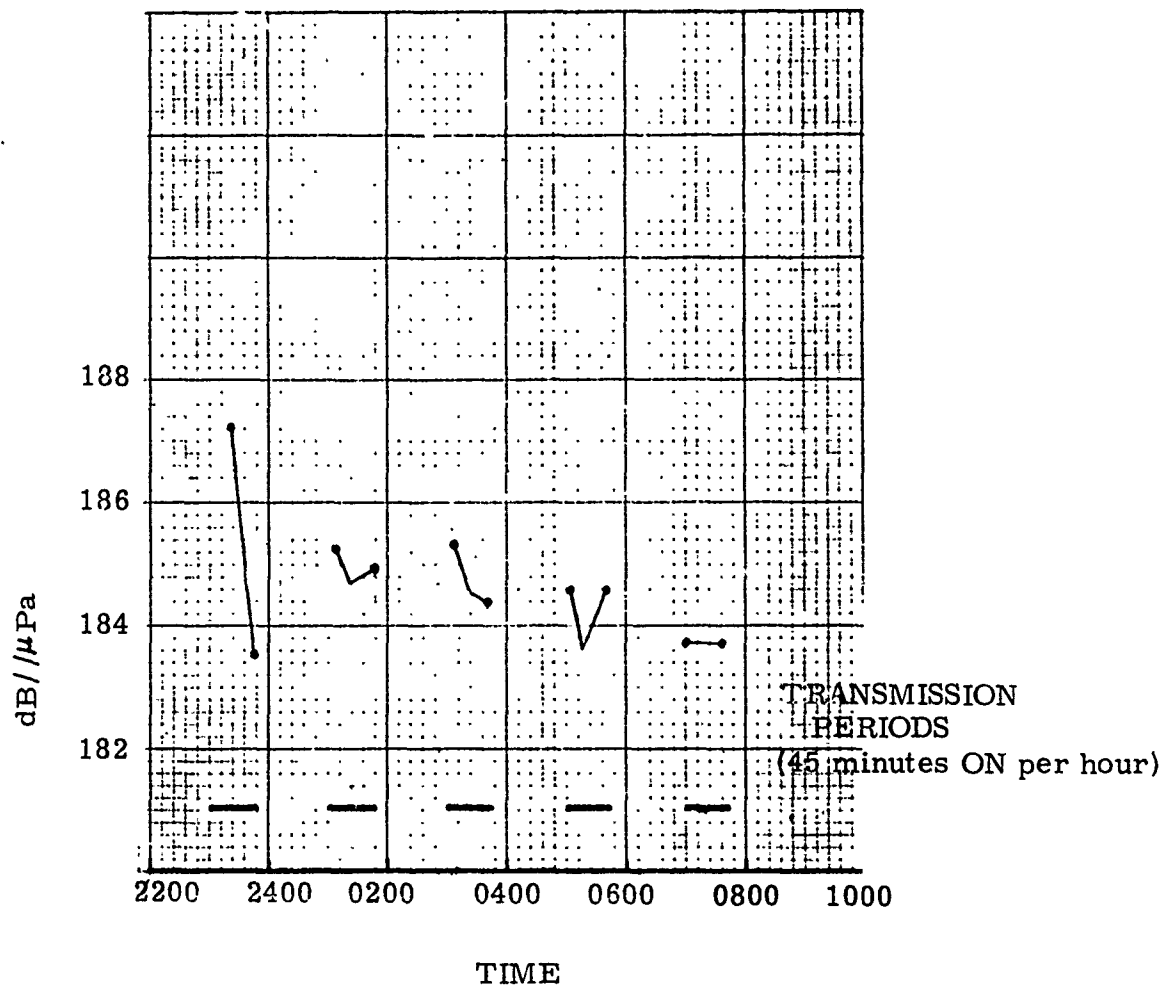
CONFIDENTIAL

EVENT MS 038

K-A TOW

DEEP SOURCE

11 Hz



GMT 16 & 17 Sept 1973

FIGURE 107

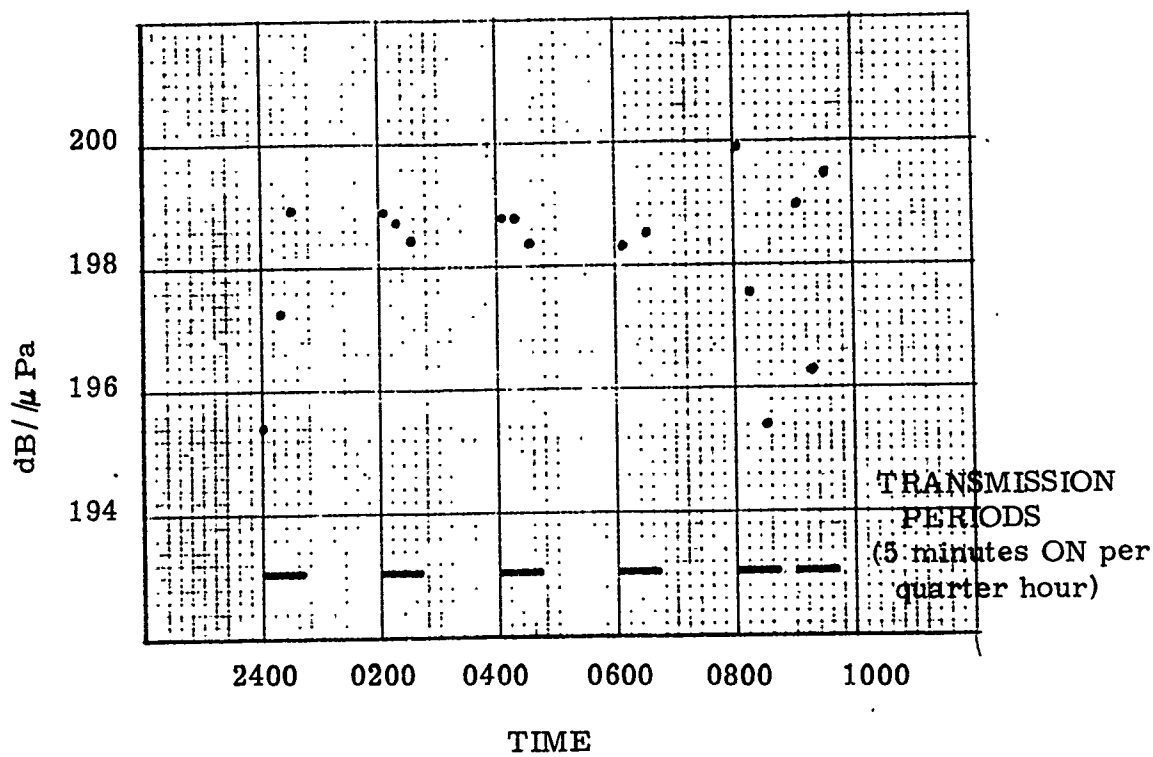
CONFIDENTIAL

EVENT MS 038

K-A TOW

DEEP SOURCE

100 Hz



GMT 16 & 17 Sept 1973

FIGURE 108

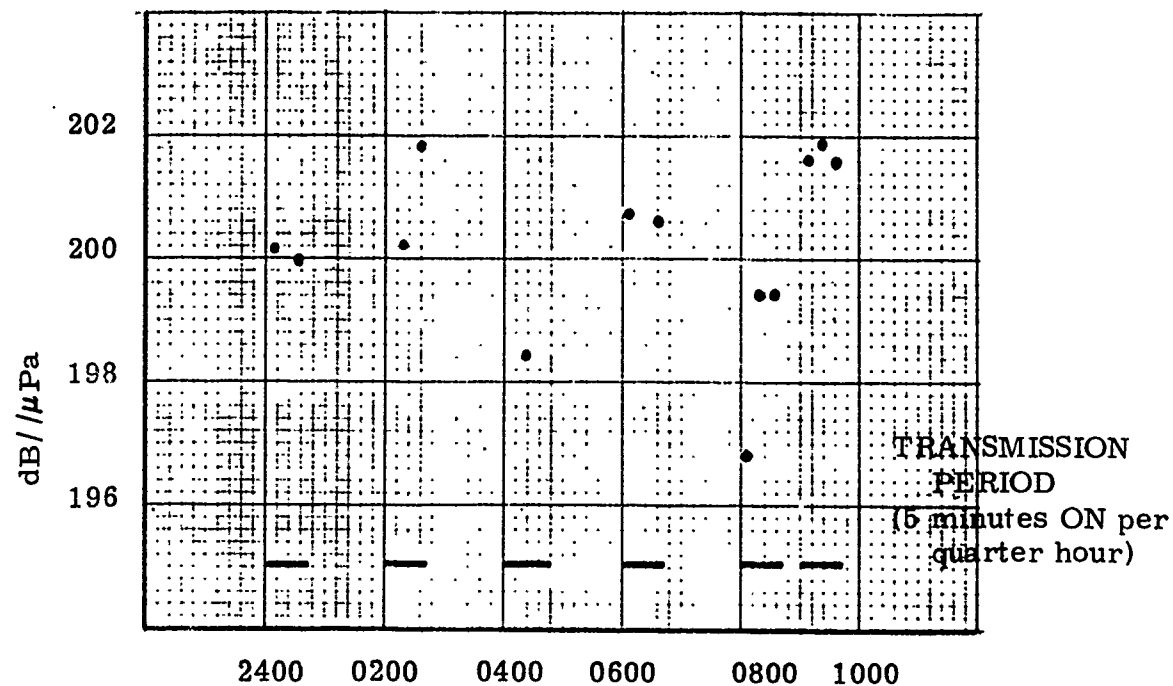
CONFIDENTIAL

EVENT MS 038

K-A TOW

DEEP SOURCE

23 Hz



TIME

GMT 16 & 17 Sept 1973

FIGURE 109

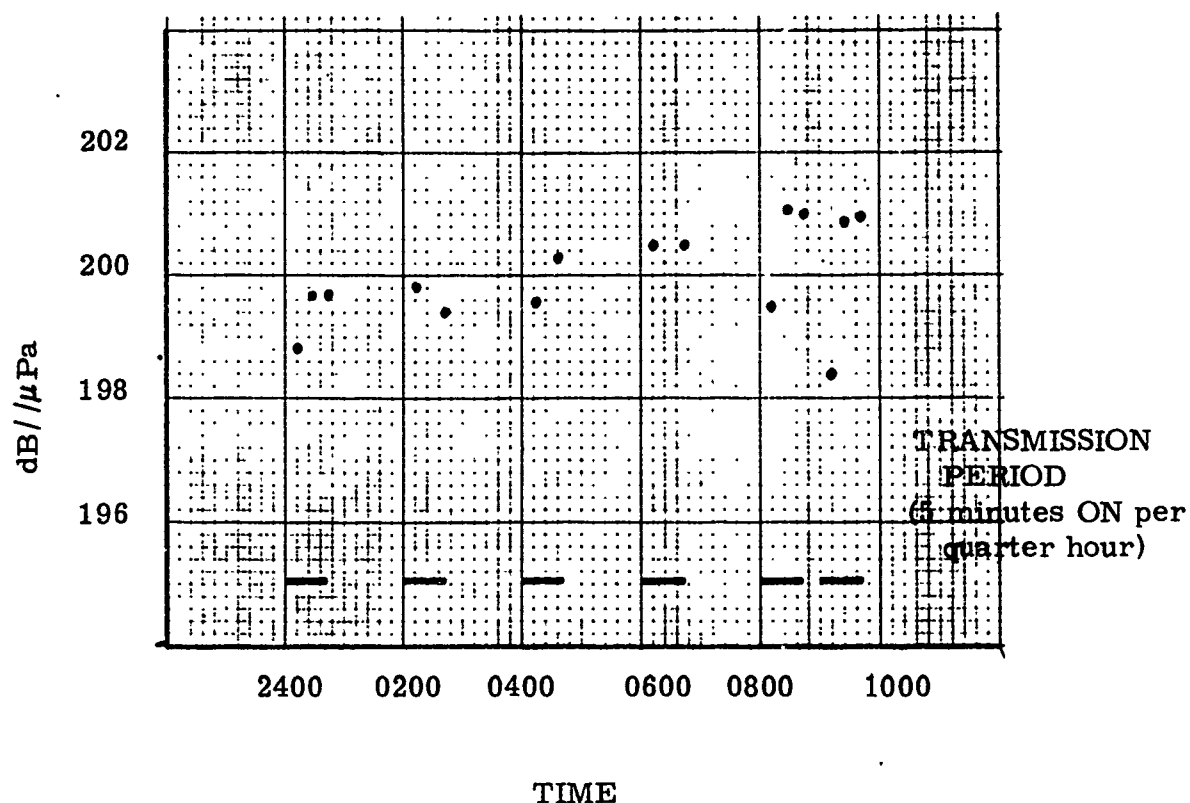
CONFIDENTIAL

EVENT MS 038

K-A TOW

DEEP SOURCE

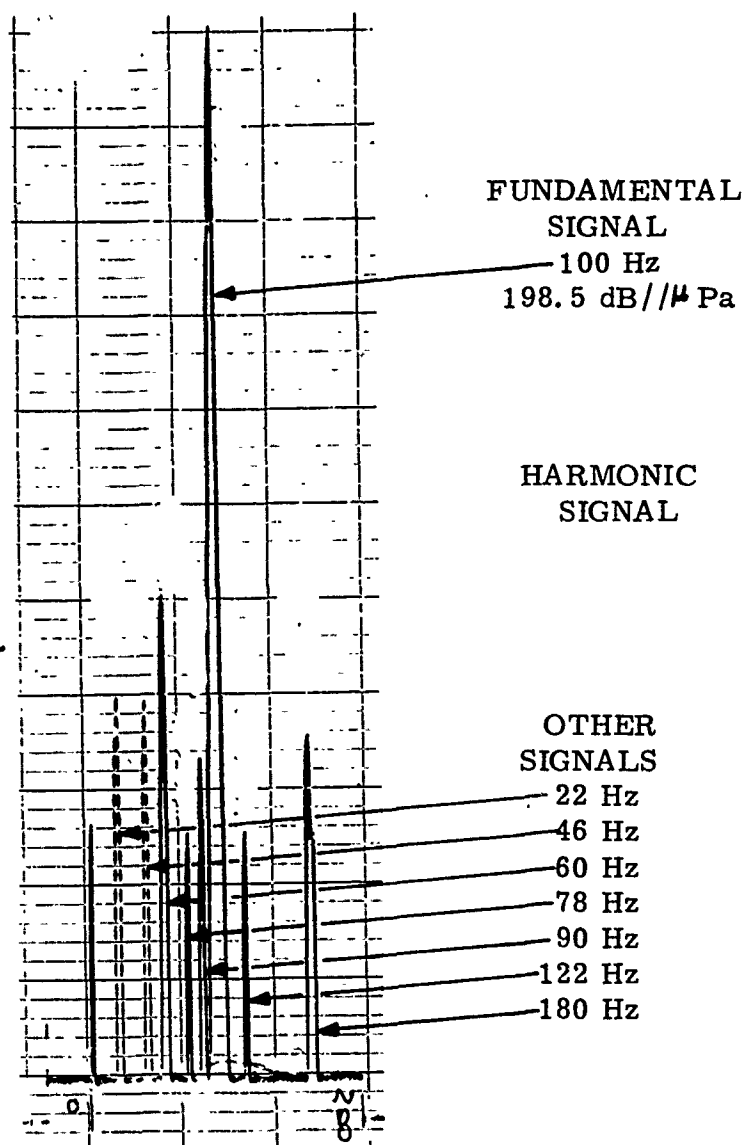
38 Hz



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EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)

SAMPLE SIGNAL SPECTRUM RECORDING



170632Z SEPT 1973

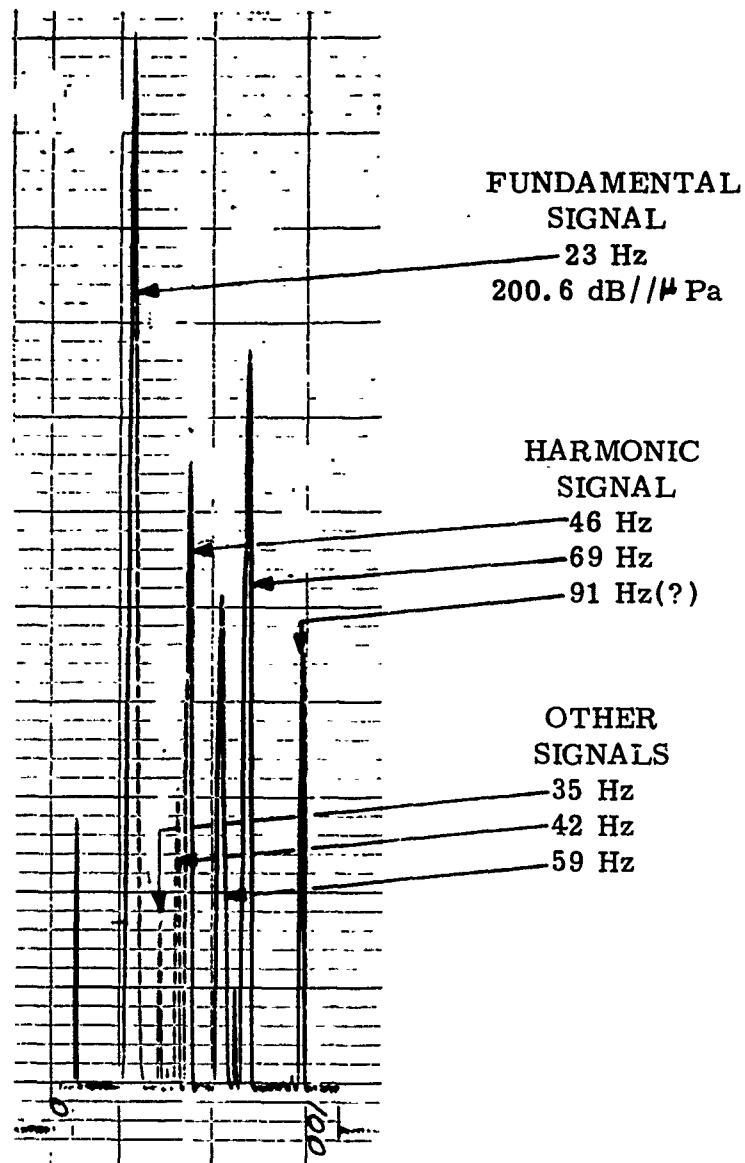
DEEP SOURCE
FIGURE 111

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EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
170637Z SEPT 1973

DEEP SOURCE

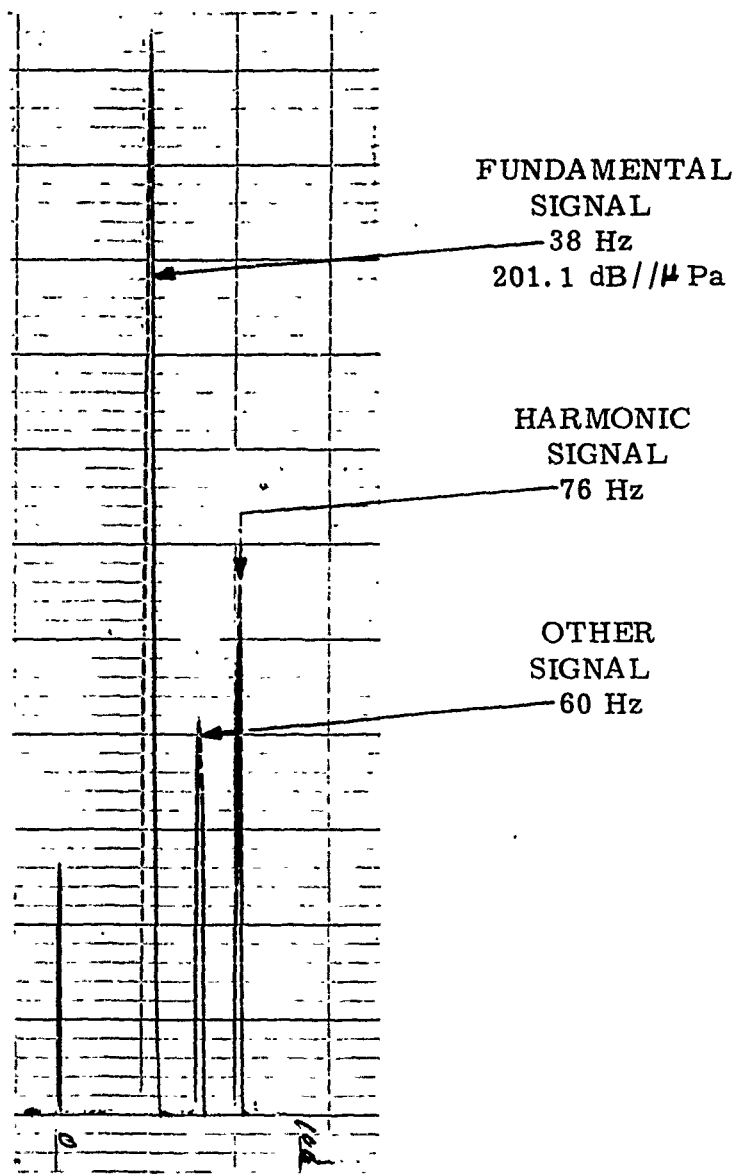
FIGURE 112

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CONFIDENTIAL

EVENT MS 038
K-A TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 23)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
170926Z SEPT 1973

DEEP SOURCE

FIGURE 113

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TABLE 48

EVENT MS 038

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
162300	DR	39° 15. 3'	146° 12. 0'
162345	F	39° 13. 2'	146° 11. 2'
170100	DR	39° 08. 0'	146° 11. 7'
170145	F	39° 05. 3'	146° 09. 8'
170245	F	38° 59. 9'	146° 07. 2'
170420	F	38° 54. 8'	146° 05. 2'
170500	DR	38° 53. 4'	146° 04. 7'
170620	F	38° 47. 7'	146° 01. 7'
170800	DR	38° 42. 6'	145° 59. 6'
170900	DR	38° 37. 9'	145° 57. 7'
170945	DR	38° 34. 9'	145° 57. 0'

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EVENT MS 039

K-A STATIC

(Data Analysis Plan Experiment Number 24)

Schedule

Shallow Source (Starboard)
171000Z Sept to 171515Z Sept
100 and 38 Hz, 45 minutes ON
at 100 Hz, and 90 minutes ON
at 38 Hz, starting at 1000 hours
at constant power levels

Deep Source
171000Z Sept to 171515Z Sept
29, 23, 11 Hz, 45 minutes ON each frequency,
45 minutes quiet period, 11, 23, 29 Hz
45 minutes ON each frequency at constant
power levels

Summary

Shallow source power levels were constant at $192 \pm \text{dB}/\mu\text{Pa}$. The deep source transmissions were not constant as shown on the plot of power level versus time. The 11 Hz transmissions were at $181 \pm 1 \text{ dB}/\mu\text{Pa}$, and the 23 and 29 Hz transmissions were within $\pm 1 \text{ dB}/\mu\text{Pa}$ at a particular power level as presented in the figure and table. Source depths were 19 meters for the shallow source, and 133 ± 3 meters for the deep source.

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TABLE 49

EVENT MS 039

K-A STATIC

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
171000 to 171053	100	191	19	Eight minutes late on frequency change
171053 to 171215	38	192	19	
171215 to 171300	100	191	19	
171300 to 171430	38	193	19	
171430 to 171515	100	191	19	End of transmission

TABLE 50

EVENT MS 039

K-A STATIC

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
171000 to 171047	29	198	131	Two minutes late on frequency change
171047 to 171130	23	197	136	
171130 to 171215	11	180	136	
171300 to 171345	11	182	132	
171345 to 171430	23	202	132	
171430 to 171515	29	195	130	

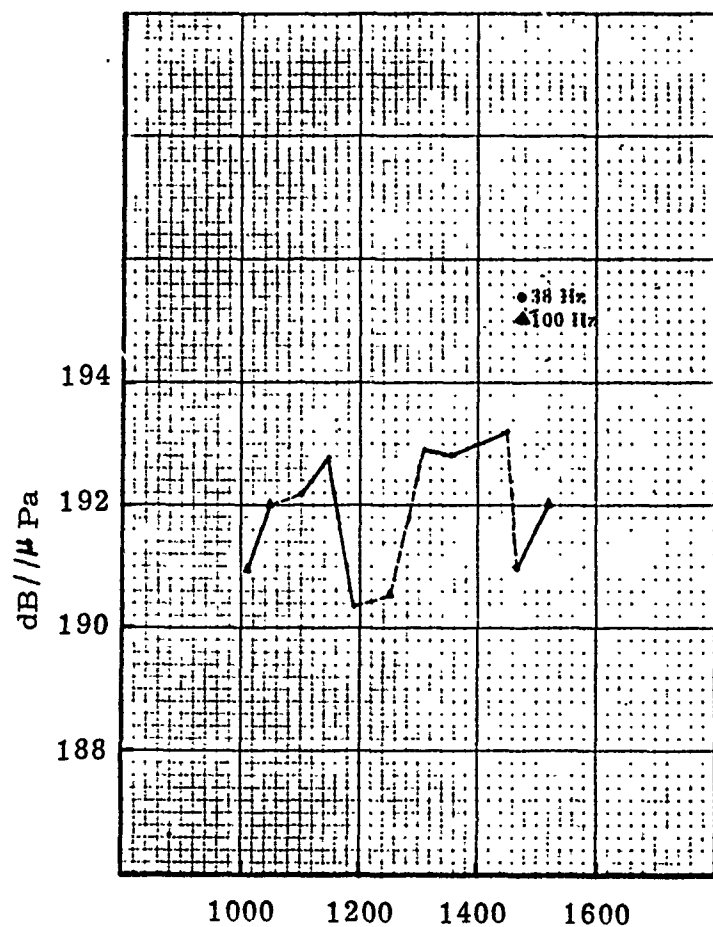
CONFIDENTIAL

EVENT MS 039

K-A STATIC

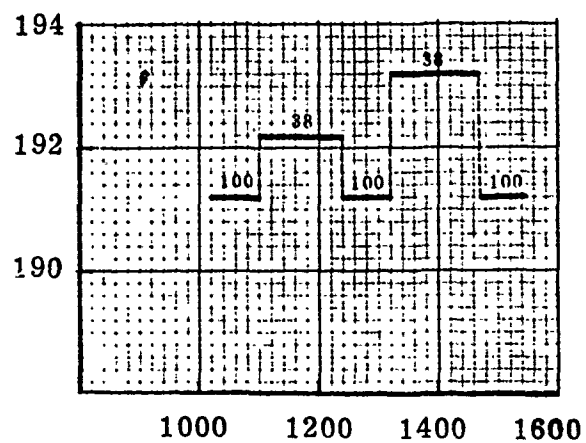
SHALLOW SOURCE

38 & 100 Hz



TIME
GMT 17 Sept 1973

PLOT OF SHALLOW
SOURCE TRANSMISSION
ASSUMING AVERAGE VALUES



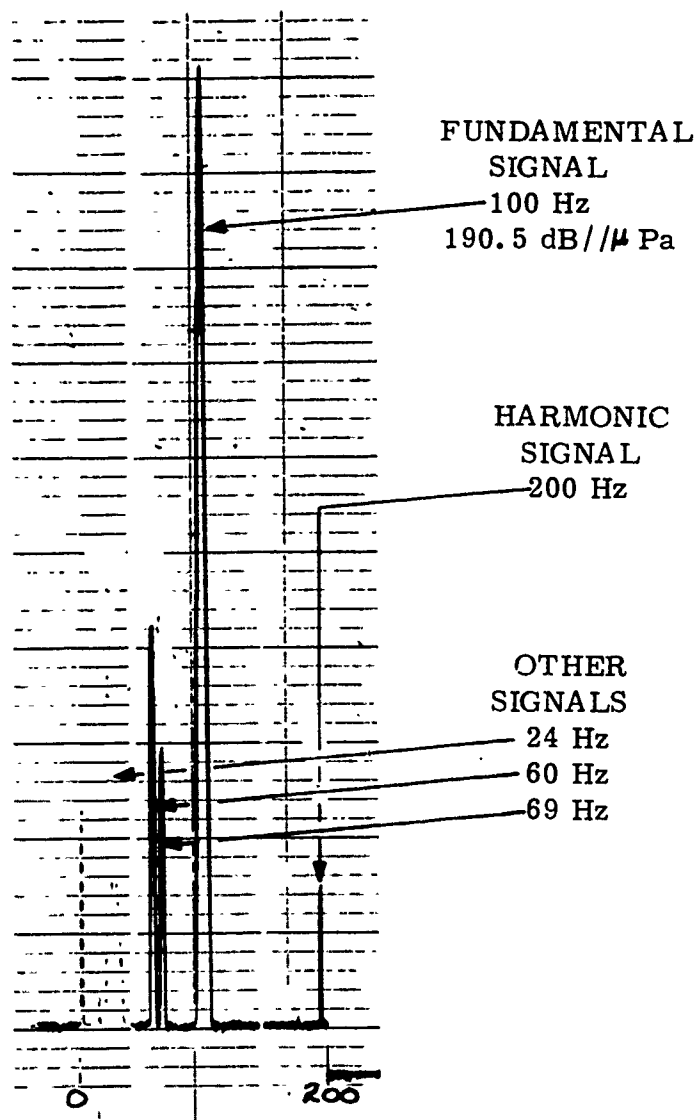
TIME
GMT 17 Sept 1973

FIGURE 114

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EVENT MS 039
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 24)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
171230Z SEPT 1973

SHALLOW SOURCE

FIGURE 115

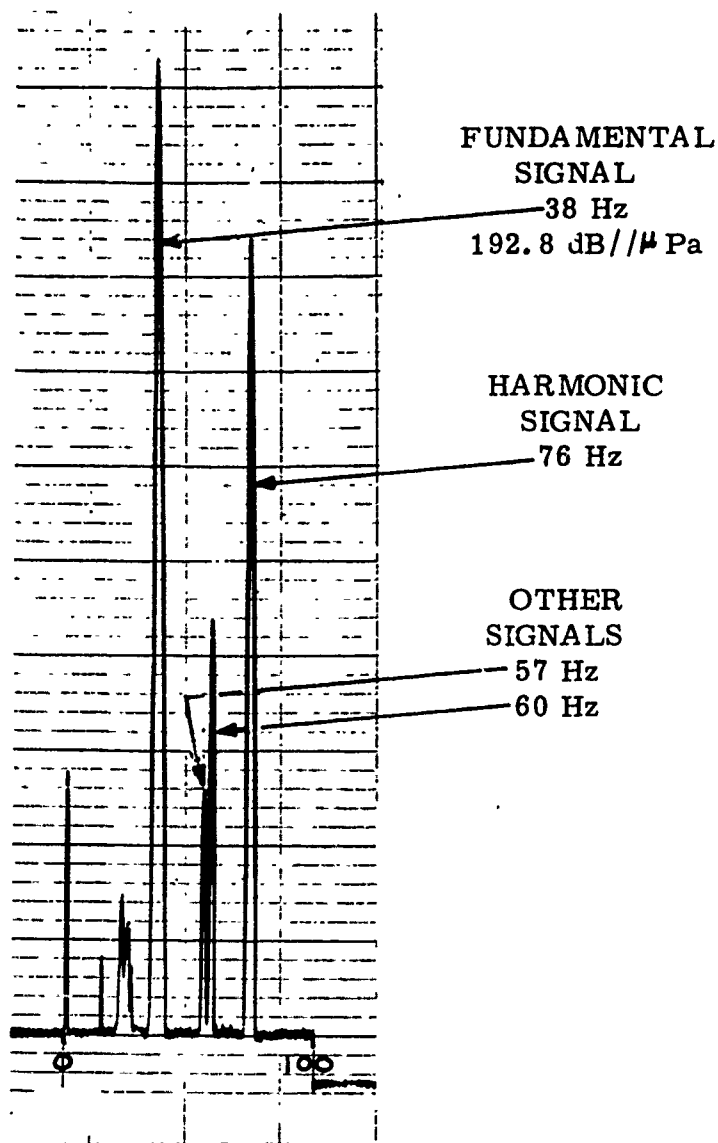
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EVENT MS 039
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 24)

SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
171304Z SEPT 1973

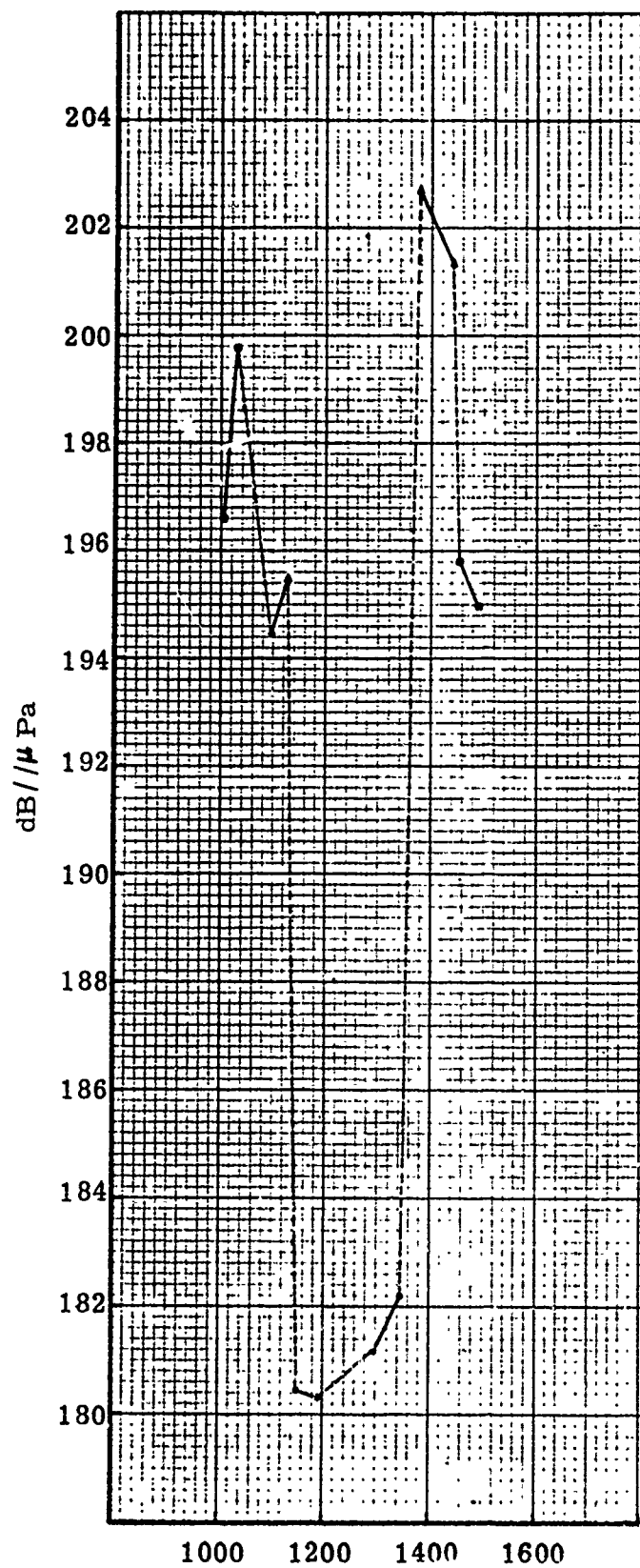
SHALLOW SOURCE

FIGURE 116

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EVENT MS 039
K-A STATIC
DEEP SOURCE

• 11 Hz
▲ 23 Hz
■ 29 Hz

PLOT OF DEEP SOURCE
TRANSMISSION ASSUMING
AVERAGE VALUES

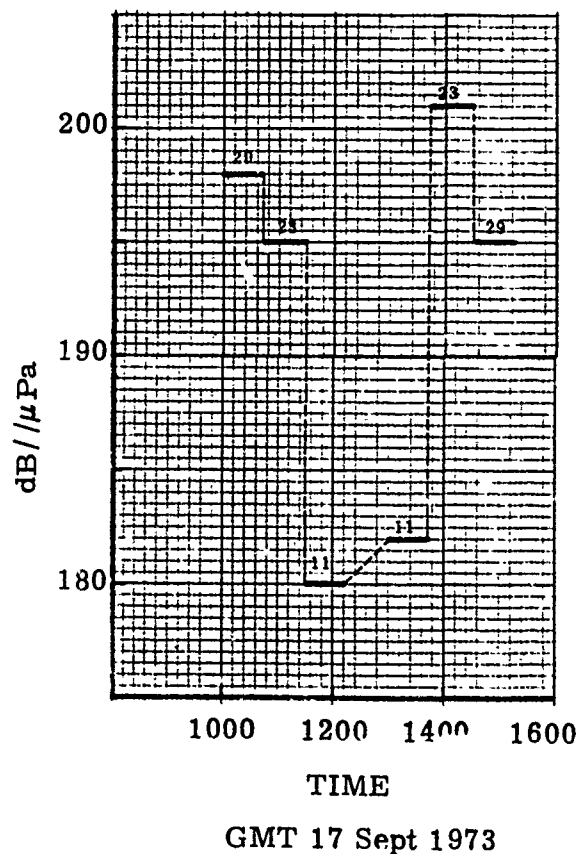


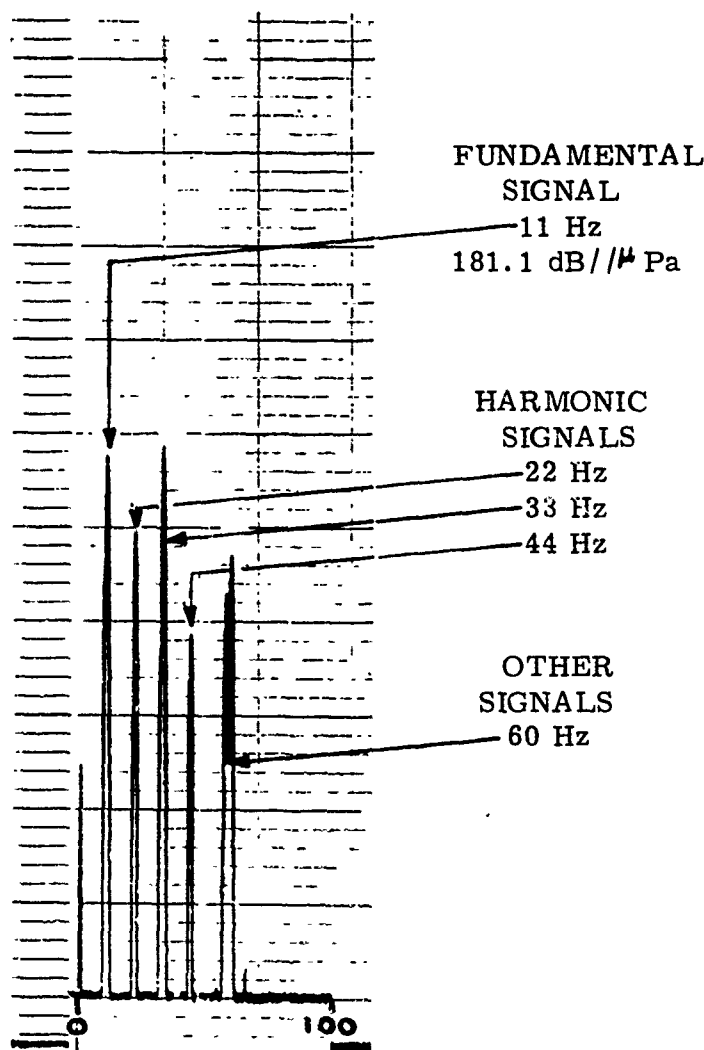
FIGURE 117
GMT 17 Sept 1973

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EVENT MS 039
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 24)
SAMPLE SIGNAL SPECTRUM RECORDING



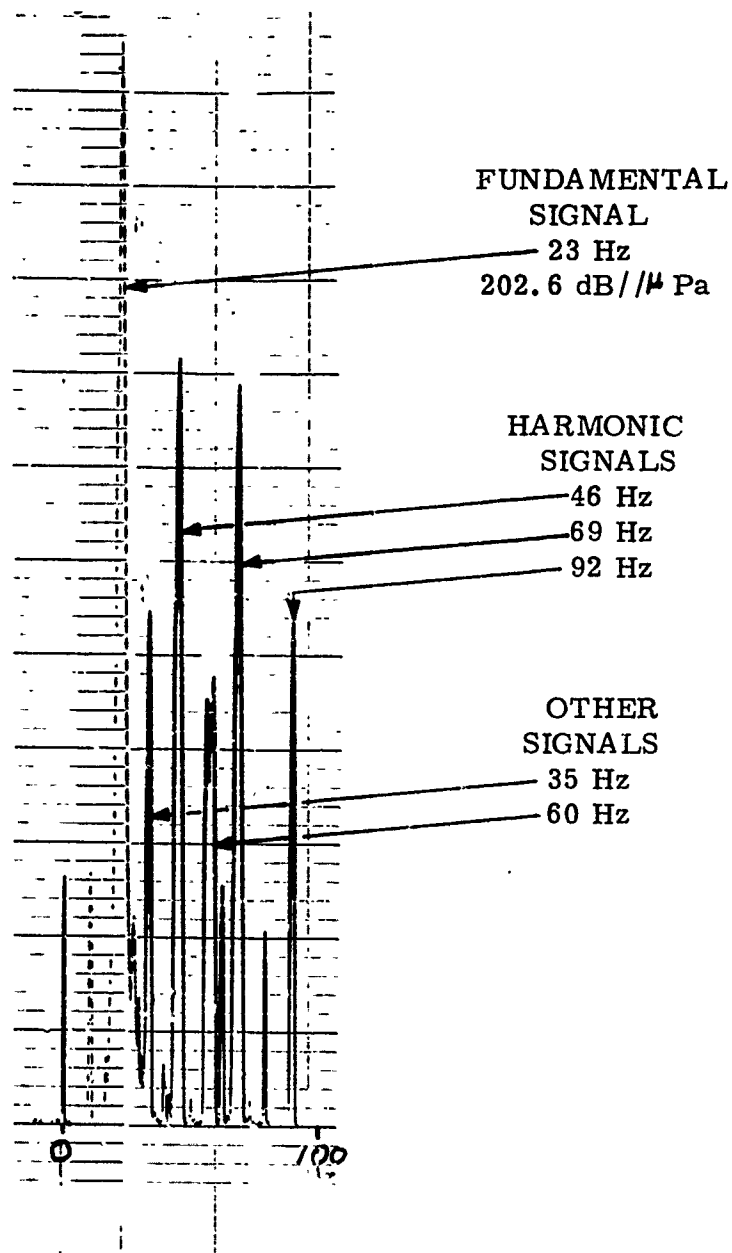
FREQUENCY
171302Z SEPT 1973

DEEP SOURCE
FIGURE 118

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EVENT MS 039
K-A STATIC
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 24)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
171350Z SEPT 1973

DEEP SOURCE

FIGURE 119

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TABLE 51

EVENT MS 039

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
171000	DR	38° 34.8'	145° 57.0'
171122	F	38° 32.8'	145° 57.2'
171316	F	38° 31.9'	145° 57.1'
171430	DR	38° 31.6'	145° 58.7'

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EVENT MS α

BASELINE TOW

(Data Analysis Plan Experiment Number 26)

Schedule

Shallow Source (Starboard)
201500Z Sept to 210323Z Sept
29 Hz, 8 minutes ON/7 minutes OFF
at a constant power level, repeated
every quarter hour

Deep Source
201906Z Sept to 202038Z Sept
See transmission schedule

Summary

On the shallow source, the first eight hours of transmission were erratic with power level excursions in the ± 3 dB/ μ Pa range. From 2300 hours to 0300 hours, the transmission power level was very steady except for a $2 \pm$ dB/ μ Pa excursion around 0130 hours. The deep source did transmit for one and a half hours, but the hydroplane was not operating, and the Vibroseis source was experiencing mechanical problems.

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TABLE 52

EVENT MS α

BASELINE TOW

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
201500 to 201508	29		19	
201515 to 201523	29	192	19	
201530 to 201538	29	194	19	
201545 to 201553	29	194	19	
201600 to 201608	29	194	19	
201615 to 201623	29	194	19	
201630 to 201638	29	192	19	
201645 to 201653	29	191	19	
201700 to 201708	29	192	19	
201715 to 201723	29	192	19	
201730 to 201738	29	192	19	
201745 to 201753	29	190	19	
201800 to 201808	29	190	19	
201815 to 201823	29	190	19	
201830 to 201838	29	189	19	
201845 to 201853	29	192	19	
201900 to 201908	29		19	
201915 to 201923	29	192	19	
201930 to 201938	29	192	19	
201945 to 201953	29	191	19	
202000 to 202008	29	191	19	
202015 to 202023	29	193	19	
202030 to 202038	29	192	19	
202045 to 202053	29	192	19	
202100 to 202108	29	191	19	
202115 to 202123	29	192	19	
202130 to 202138	29	188	19	
202145 to 202153	29	192	19	
202200 to 202208	29		18	
202215 to 202223	29		19	
202230 to 202238	29	194	19	
202245 to 202253	29	194	19	
202300 to 202308	29	195	19	
202315 to 202323	29	195	19	
202330 to 202338	29	194	19	
202345 to 202353	29	194	19	
210000 to 210008	29	194	19	
210015 to 210023	29	195	19	
210030 to 210038	29	194	19	
210045 to 210053	29	194	19	

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TABLE 52 (Continued)

EVENT MS α

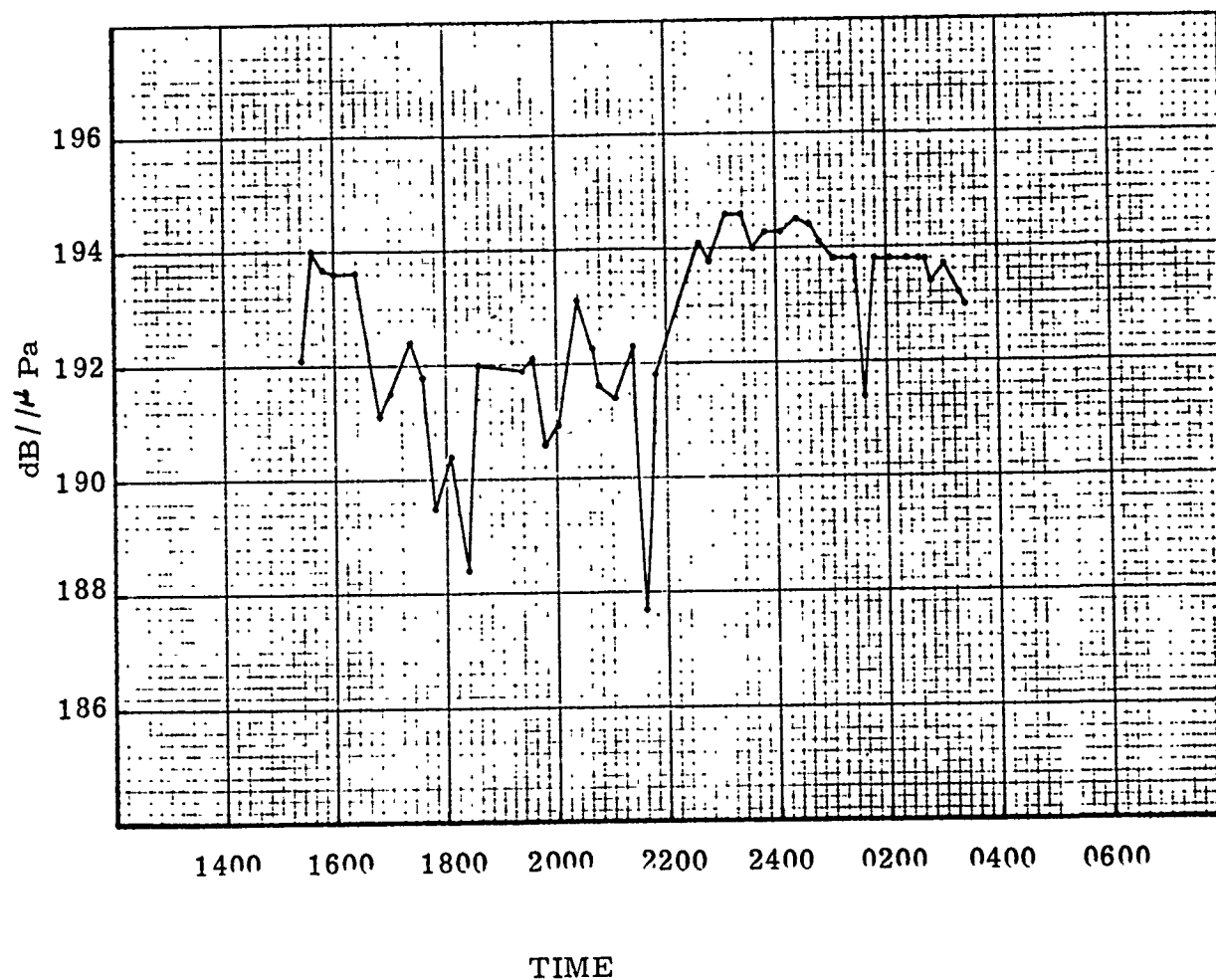
INBOUND

SHALLOW SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
210100 to 210108	29	194	19	Transmission terminated due to rough seas
210115 to 210123	29	194	19	
210130 to 210138	29	191	19	
210145 to 210153	29	191	19	
210200 to 210208	29	194	19	
210215 to 210223	29	194	19	
210230 to 210238	29	194	19	
210245 to 210253	29	194	19	
210300 to 210308	29	194	19	
210315 to 210323	29	193	19	

CONFIDENTIAL

EVENT MS α
BASELINE TOW
SHALLOW SOURCE
29 Hz

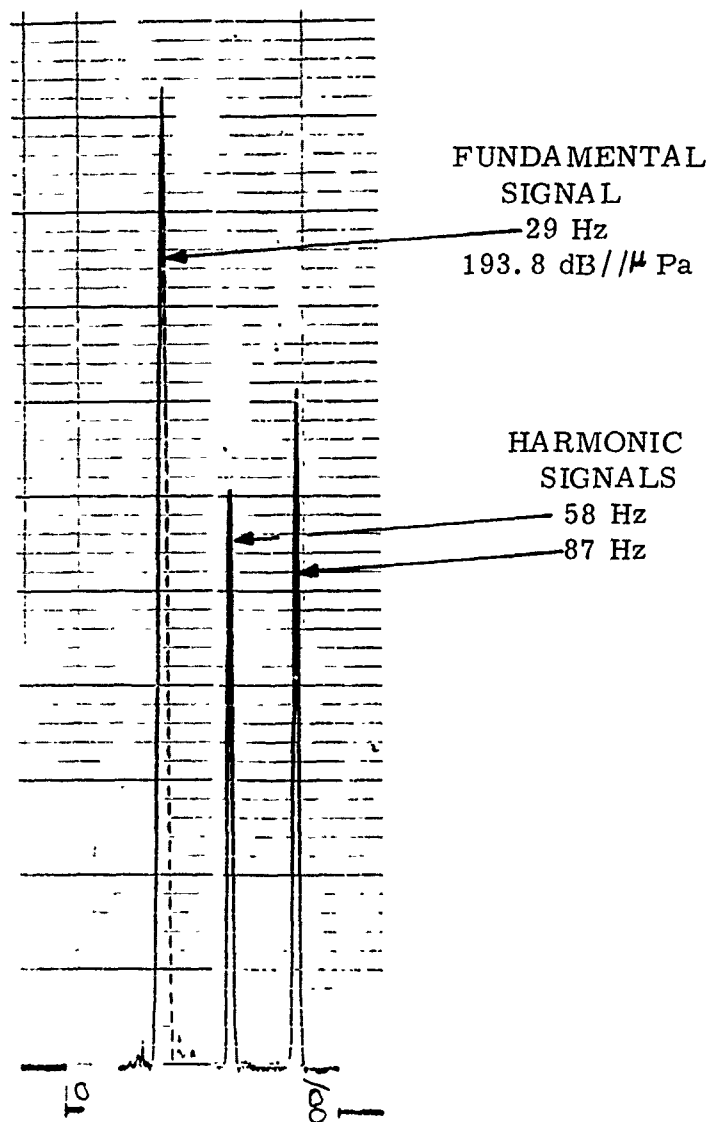


TIME
GMT 20 & 21 Sept 1973

FIGURE 120

CONFIDENTIAL

EVENT MS α
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 26)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
210222Z SEPT 1973

SHALLOW SOURCE

FIGURE 121

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TABLE 53

EVENT MS α

BASELINE TOW

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB//μPa	DEPTH METERS	
201906 to 201908	23	. *	126	
201915 to 201923	38		116	
201930 to 201938	23		116	
201945 to 201953	38		116	
202000 to 202008	100		116	
202015 to 202023	23		103	
202030 to 202038	38		103	
*No signal on hydrophone. Therefore unable to determine sound power level being transmitted by the source.				

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TABLE 54

EVENT MS α

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
201512	F	39° 48.9'	143° 28.5'
201630	F	39° 42.8'	143° 28.3'
201730	DR	39° 38.6'	143° 28.8'
201915	F	39° 34.0'	143° 27.9'
202015	F	39° 30.0'	143° 28.2'
202123	DR	39° 27.5'	143° 27.3'
202145	DR	39° 26.9'	143° 27.1'
202215	F	39° 25.9'	143° 27.6'
202253	DR	39° 24.9'	143° 30.0'
202345	F	39° 21.4'	143° 29.4'
210045	DR	39° 17.2'	143° 29.6'
210145	F	39° 13.8'	143° 38.2'
210245	DR	39° 10.7'	143° 28.8'
210315	F	39° 09.2'	143° 27.7'

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EVENT MS β

INBOUND TOW

(Data Analysis Plan Experiment Number 33)

Schedule

Shallow Source (Starboard)
260100Z Sept to 260155Z Sept
38 Hz, 55 minutes ON/5 minutes OFF
at constant power level

Deep Source
221902Z Sept to 232128Z Sept
232342Z Sept to 240655Z Sept
241126Z Sept to 241143Z Sept
242135Z Sept to 242155Z Sept
260200Z Sept to 261135Z Sept
38 Hz, 55 minutes ON/5 minutes OFF
at constant power level repeated every hour

Summary

Shallow source was only used as a replacement for the deep source when it was experiencing equipment problems. After a 2 hour start up, during which the deep source gradually increased to the required power level, the source averaged 196 ± 2 dB/ μ Pa, and at times ± 1 dB/ μ Pa, as can be seen on the power level versus time plots. After a quiet period of over 24 hours, the source was back on line but was erratic with large variations at first, then leveling out to ± 1 dB/ μ Pa. Weather was poor during this period, but equipment problems were the major cause of down time. During the complete transmission period, the deep source maintained a 105 ± 5 meter depth.

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TABLE 55
EVENT MS β
INBOUND

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
260100 to 260155	38	192	~18	

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TABLE 56

EVENT MS β

INBOUND

DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
221902 to 221950	38	188	106	OFF One minute for radio transmission
222001 to 222055	38	195	109	
222100 to 222155	38	197	109	
222200 to 222255	38	198	109	
222300 to 222355	38	198	108	OFF four minutes for filter change
230000 to 230047	38	197	108	
230048 to 230055	38	197	108	
230100 to 230155	38	197	110	
230200 to 230220	38	198	109	Transmission OFF for radio transmissions
230224 to 230255	38	198	110	
230300 to 230355	38	198	110	
230400 to 230455	38	197	110	
230500 to 230555	38	197	110	
230600 to 230607	38	199	110	
230612 to 230650	38	199	110	
230651 to 230656	38	199	111	
230700 to 230755	38	196	109	
230800 to 230855	38	196	109	
230900 to 230955	38	196	110	
231000 to 231055	38	196	110	
231100 to 231155	38	196	110	
231200 to 231255	38	196	109	
231300 to 231355	38	196	110	
231400 to 231455	38	196	110	
231500 to 231555	38	195	109	
231600 to 231655	38	195	109	
231700 to 231755	38	195	109	
231800 to 231855	38	196	109	
231900 to 231955	38	193	109	OFF due to source problems
232000 to 232055	38	195	110	
232100 to 232110	38	195	111	
232112 to 232128	38	195	111	
232342 to 232355	38		111	
240000 to 240055	38	196	111	
240100 to 240155	38	195	111	
240200 to 240255	38	196	108	
240300 to 240355	38	196	111	

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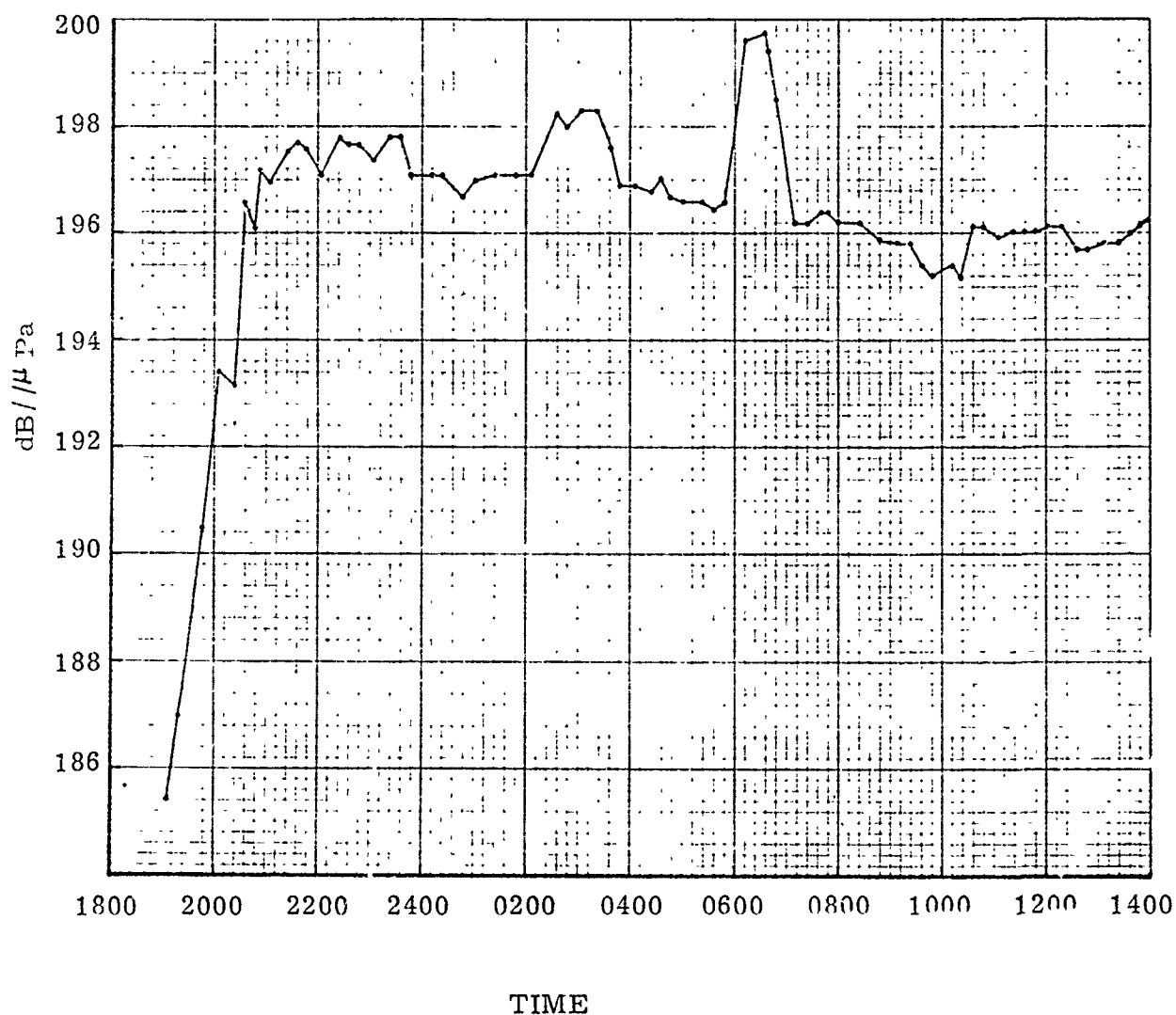
TABLE 56 (Continued)
EVENT MS β
INBOUND

DEEP SOURCE (Continued)

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
240400 to 240455	38	196	111	Scheduled four hour quiet period Late start, then electrical problems
240500 to 240555	38	196	111	
240600 to 240655	38	196	111	
241126 to 241143	38	195	103	Scheduled three hour quiet period Could not transmit on schedule due to source problems
242135 to 242155	38	196	110	
260200 to 260255	38	191	108	End of event
260300 to 260355	38	190	108	
260400 to 260455	38	191	104	
260500 to 260555	38	189	104	
260600 to 260655	38	192	104	
260700 to 260755	38	193	105	
260801 to 260855	38	192	105	
260900 to 260955	38	193	105	
261000 to 261055	38	194	105	
261100 to 261135	38	193	103	

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EVENT MS β
INBOUND TOW
DEEP SOURCE
38 Hz



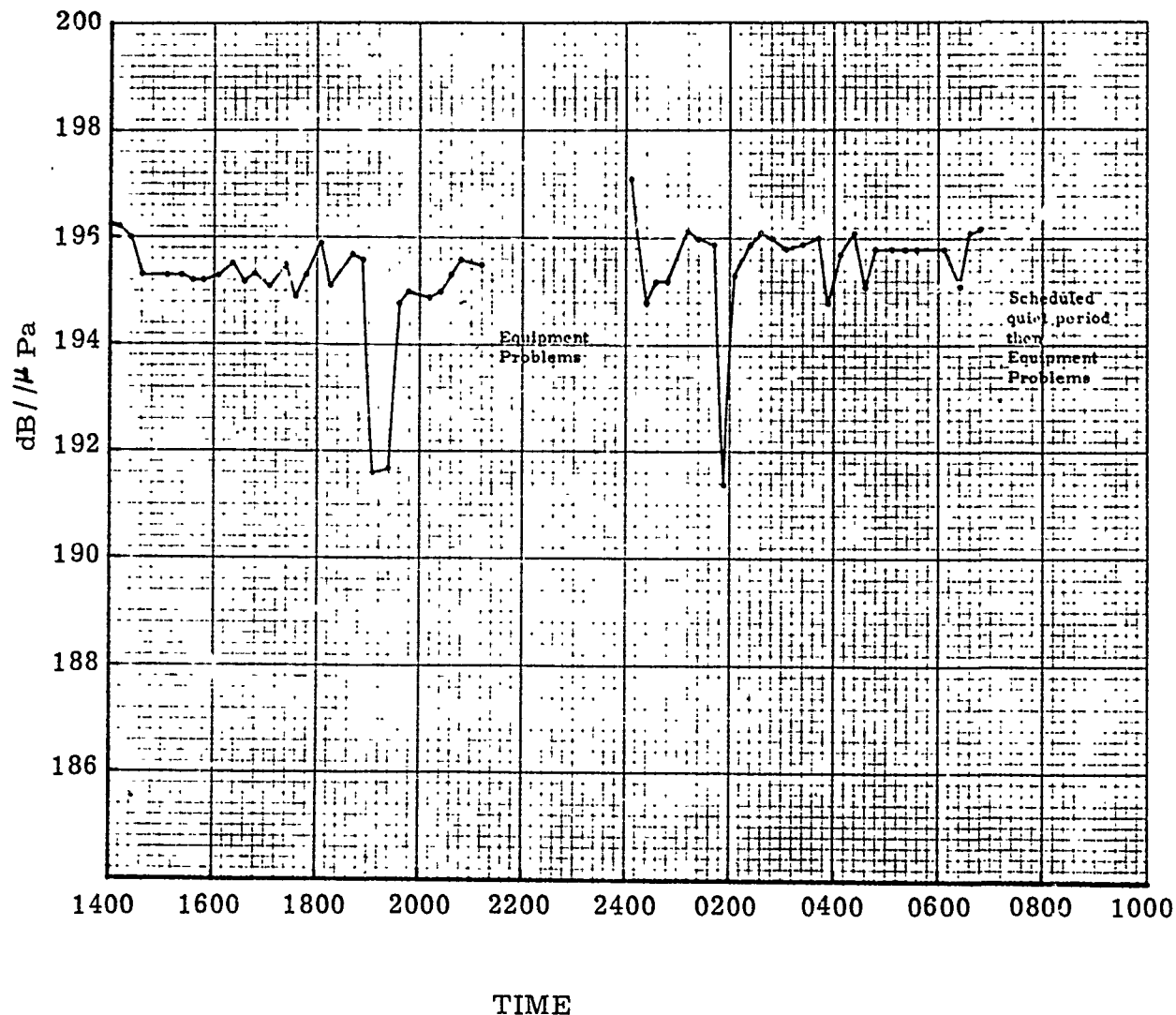
GMT 22 & 23 Sept 1973

FIGURE 122

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EVENT MS β
CONTINUED
INBOUND TOW
DEEP SOURCE
38 Hz



GMT 23 & 24 Sept 1973

FIGURE 123

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EVENT MS β

(Continued)

INBOUND TOW

DEEP SOURCE

38 Hz

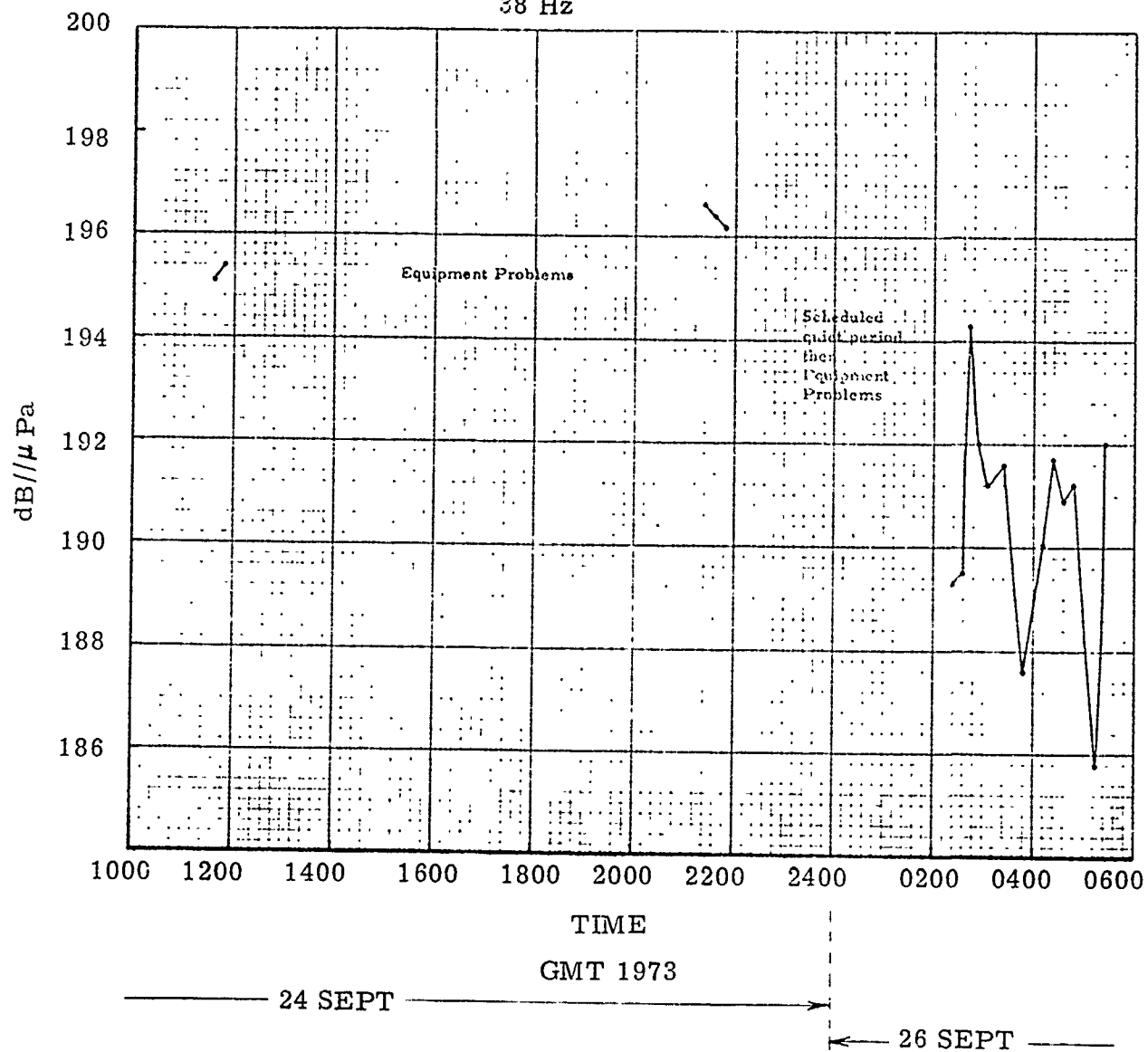
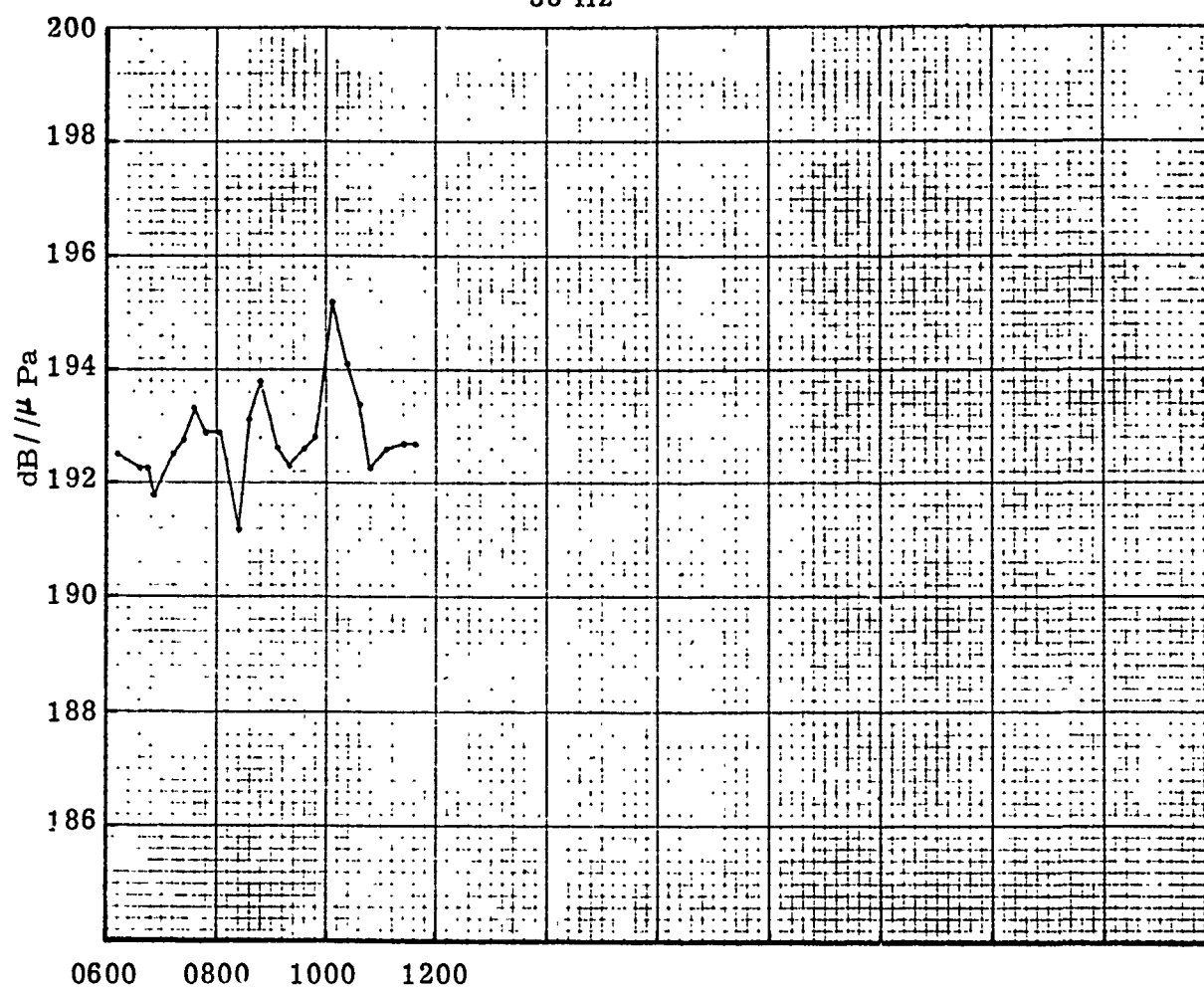


FIGURE 124

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EVENT MS β
CONTINUED
INBOUND TOW
DEEP SOURCE
38 Hz



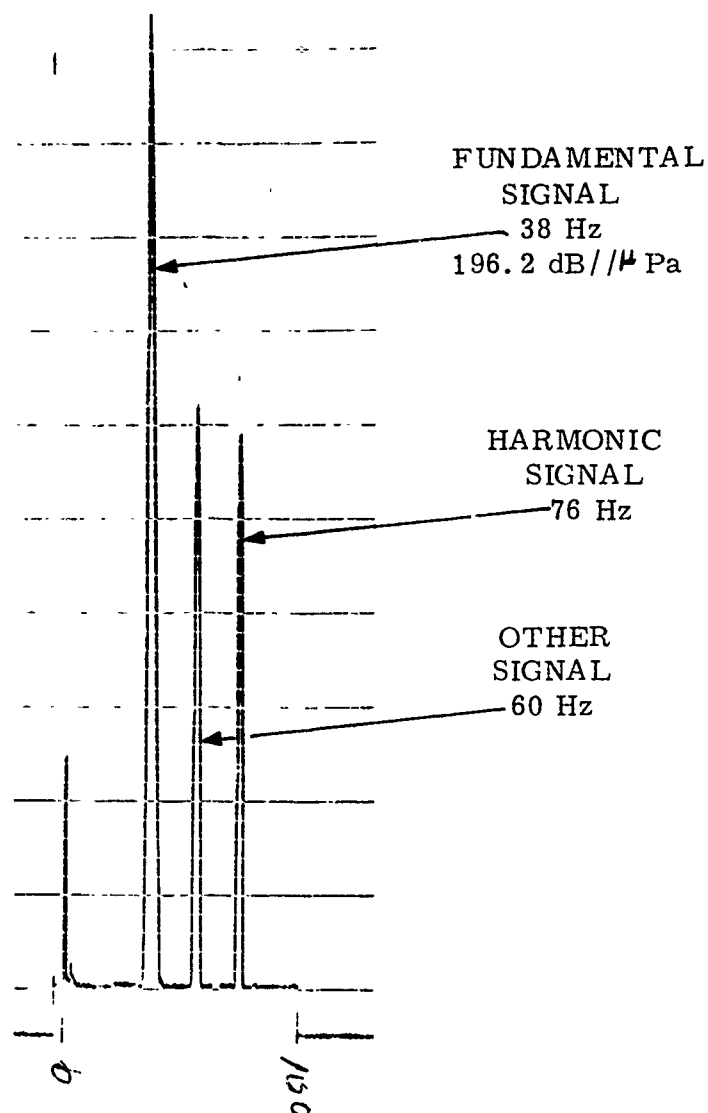
TIME
GMT 26 Sept 1973

FIGURE 125

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EVENT MS^B
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 33)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
231017Z SEPT 1973

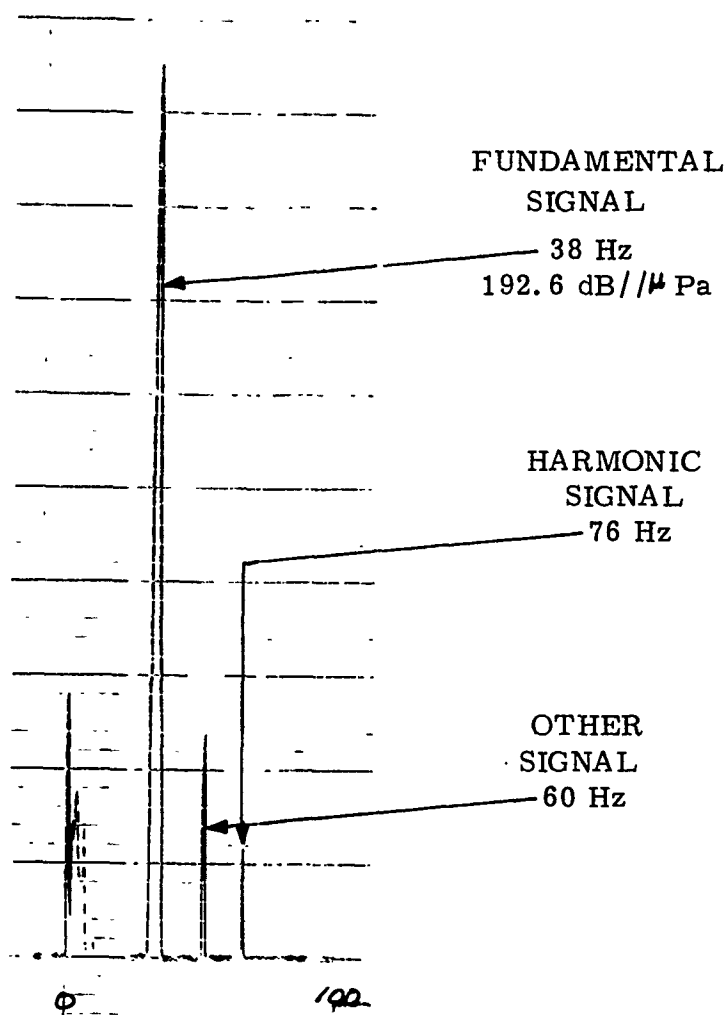
DEEP SOURCE
FIGURE 126

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EVENT MS~~6~~
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 33)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
260903Z SEPT 1973

DEEP SOURCE
FIGURE 127

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TABLE 57

EVENT MS β

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE °N	LONGITUDE °W
221922	F	37° 26. 2'	140° 44. 9'
222000	F	37° 25. 3'	140° 41. 7'
222100	F	37° 24. 1'	140° 36. 5'
222200	DR	37° 23. 7'	140° 36. 7'
222300	DR	37° 21. 8'	140° 27. 7'
222335	F	37° 22. 1'	140° 24. 2'
230100	DR	37° 20. 6'	140° 17. 0'
230155	F	37° 19. 9'	140° 13. 6'
230300	F	37° 18. 8'	140° 08. 1'
230400	F	37° 18. 3'	140° 03. 1'
230455	F	37° 17. 6'	139° 59. 0'
230600	DR	37° 16. 3'	139° 53. 8'
230656	F	37° 16. 3'	139° 49. 4'
230740	F	37° 15. 7'	139° 45. 4'
230900	DR	37° 14. 3'	139° 38. 4'
231034	F	37° 12. 6'	139° 29. 9'
231140	F	37° 10. 9'	139° 23. 6'
231300	DR	37° 09. 3'	139° 17. 5'
231434	F	37° 07. 2'	139° 08. 1'
231600	DR	37° 05. 3'	139° 01. 2'
231700	DR	37° 03. 4'	138° 55. 8'
231800	DR	37° 02. 0'	138° 51. 6'
231907	F	36° 59. 1'	138° 45. 8'
232055	DR	36° 55. 4'	138° 36. 0'
232128	DR	36° 54. 9'	138° 34. 4'
232342	DR	37° 01. 6'	138° 27. 7'
240100	DR	36° 59. 1'	138° 24. 6'
240217	F	36° 57. 2'	138° 17. 8'
240300	DR	36° 56. 7'	138° 14. 5'
240400	F	36° 56. 5'	138° 08. 8'
240500	DR	36° 56. 0'	138° 03. 5'
240600	F	36° 55. 0'	138° 58. 6'
241126	DR	36° 47. 3'	137° 30. 1'

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TABLE 57 (Continued)

EVENT MS β

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
242143	F	36° 40.9'	136° 57.1'
252344	DR	36° 19.0'	134° 43.6'
260050	DR	36° 10.5'	134° 40.0'
260138	F	36° 10.2'	134° 37.1'
260227	F	36° 09.5'	134° 35.0'
260300	DR	36° 08.2'	134° 34.5'
260400	F	36° 06.4'	134° 29.8'
260455	DR	36° 05.9'	134° 26.4'
260600	DR	36° 05.0'	134° 21.7'
260700	DR	36° 03.5'	134° 19.2'
260802	F	36° 02.5'	134° 15.6'
260900	DR	36° 01.7'	134° 11.3'
261000	DR	36° 00.8'	134° 07.2'
261100	DR	35° 59.8'	134° 03.2'

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EVENT MS 0

INBOUND TOW

(Data Analysis Plan Experiment Number 33)

Schedule

Shallow Source (Starboard)

270600Z Sept to 270849Z Sept

38 Hz, 55 minutes ON/5 minutes OFF

at constant power level, repeated every hour

Deep Source

261135Z Sept to 270542Z Sept

38 Hz, 55 minutes ON/5 minutes OFF

at constant power level, repeated every hour

Summary

The first seven hours transmission were steady and source level varied ± 1 dB/ μ Pa.

At 1800 hours, the system started to experience difficulties, and power levels gradually decreased over the next six hours, an average of one dB/ μ Pa per hour. Attempts were made to increase the source power level, which was accomplished, but variations in source power level was ± 4 dB/ μ Pa. Finally the deep source failed and the shallow source replaced it for the next three hours until the Exercise was terminated.

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TABLE 58
EVENT MS 6
INBOUND TOW

SHALLOW SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
270600 to 270620	38	193	21	Shallow source being used in lieu of the deep one
270625 to 270655	38	192	21	
270700 to 270755	38	192	23	
270800 to 270849	38	191	23	End of Exercise.

TABLE 59
EVENT MS 6
INBOUND TOW

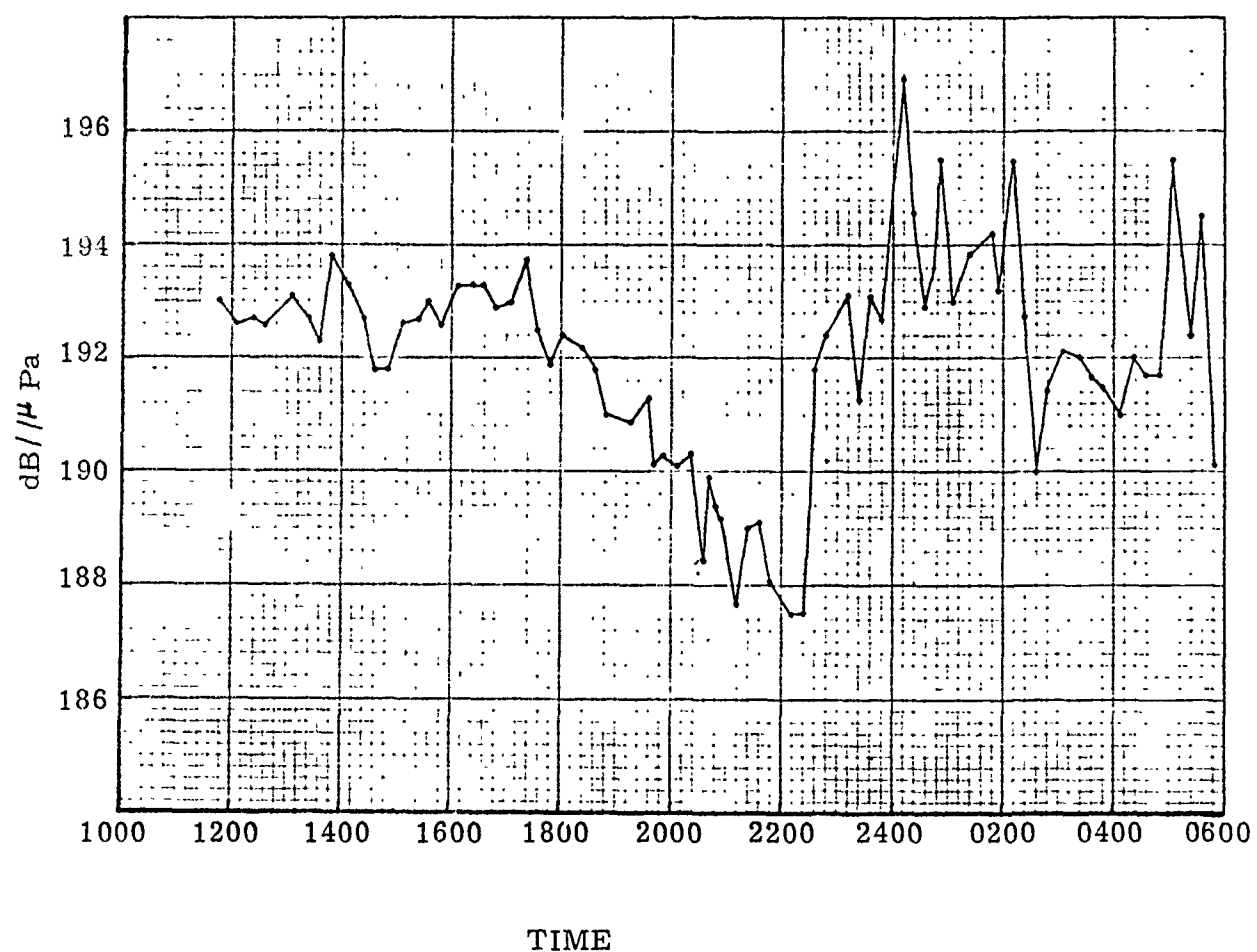
DEEP SOURCE

TIME GMT SEPT 1973	SOURCE			REMARKS
	FREQ Hz	SPL dB// μ Pa	DEPTH METERS	
261135 to 261155	38	193	103	Hydraulic pump breakdown Cooling water problems
261200 to 261255	38	193	103	
261300 to 261355	38	193	103	
261400 to 261455	38	192	102	
261500 to 261555	38	193	99	
261600 to 261655	38	193	98	
261700 to 261755	38	192	98	
261800 to 261855	38	192	98	
261900 to 261955	38	191	98	
272000 to 262055	38	190	99	
262100 to 262155	38	188	103	
262200 to 262255	38	190	103	
262300 to 262355	38	193	102	
270006 to 270055	38	195	103	
270100 to 270105	38	193	101	
270113 to 270122	38	193	101	
270134 to 270155	38	193	101	
270200 to 270255	38	192	101	
270300 to 270355	38	192	101	
270400 to 270455	38	192	103	
270504 to 270547	38	193	101	No output from source

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EVENT MS 0
INBOUND TOW
DEEP SOURCE
38 Hz

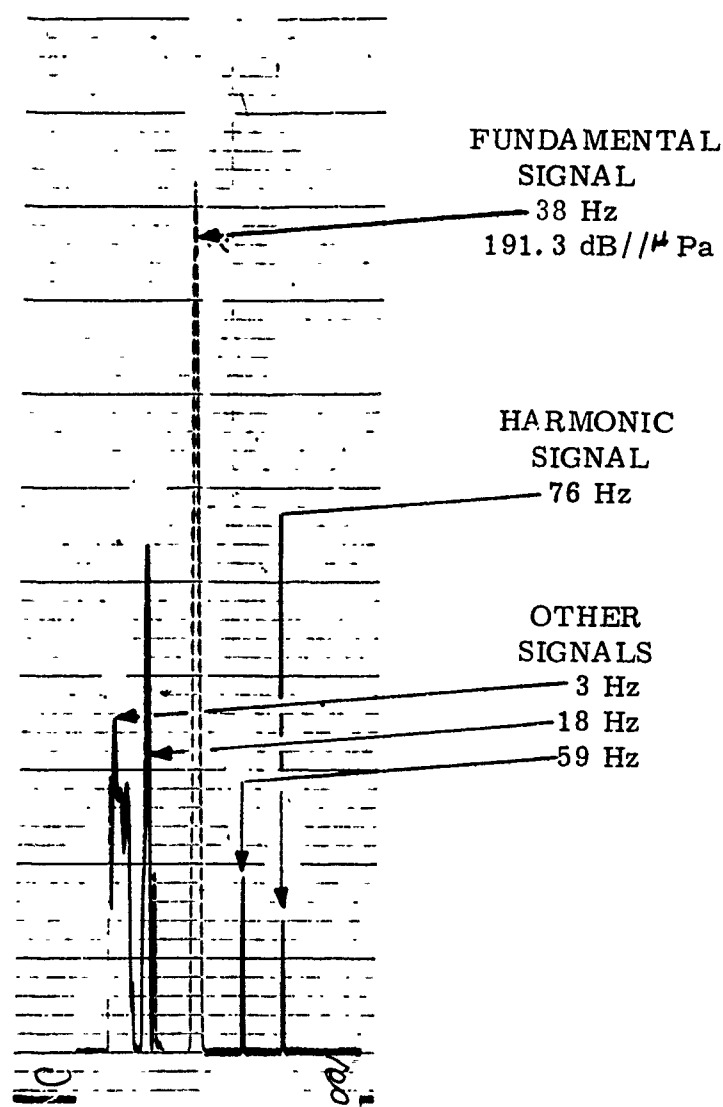


TIME
GMT 26 & 27 Sept 1973

FIGURE 128

CONFIDENTIAL

EVENT MS 0
INBOUND TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 33)
SAMPLE SIGNAL SPECTRUM RECORDING



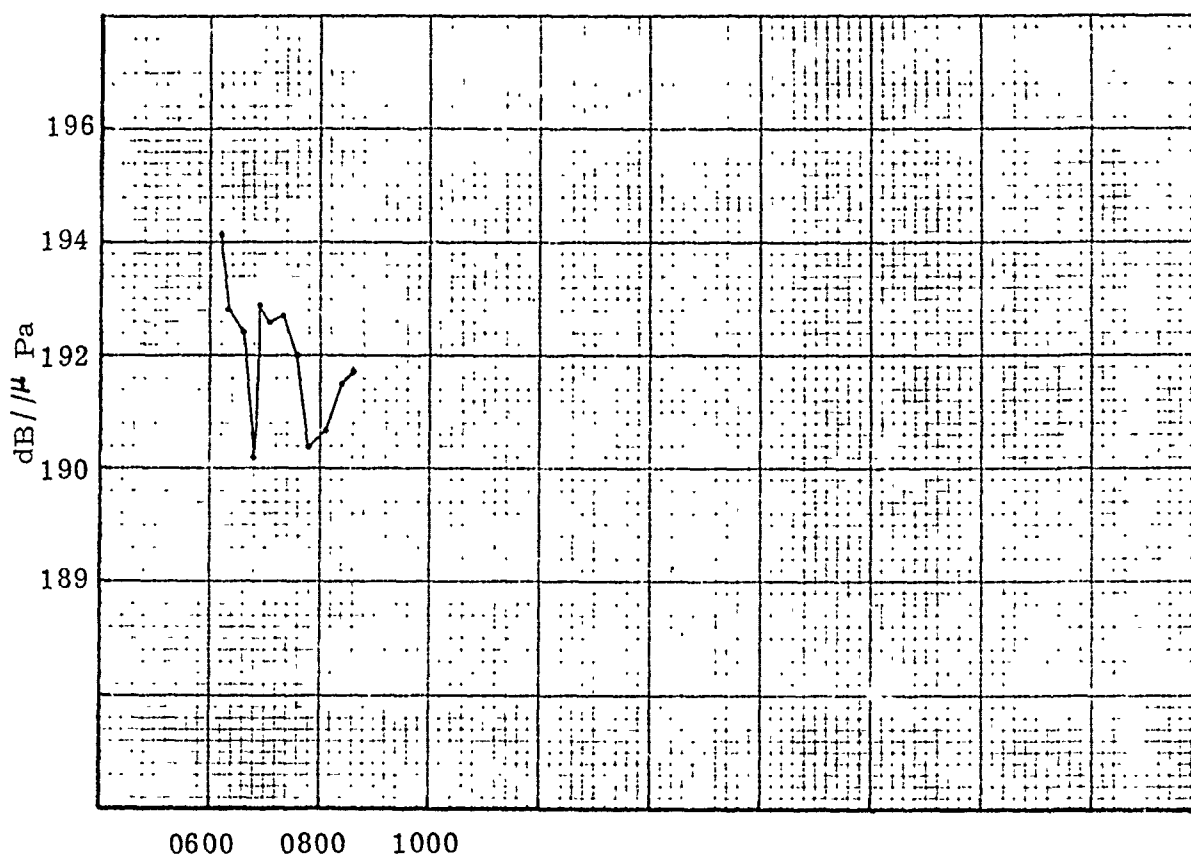
FREQUENCY
262324Z SEPT 1973

DEEP SOURCE
FIGURE 129
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EVENT MS 0
INBOUND TOW
SHALLOW SOURCE
38 Hz

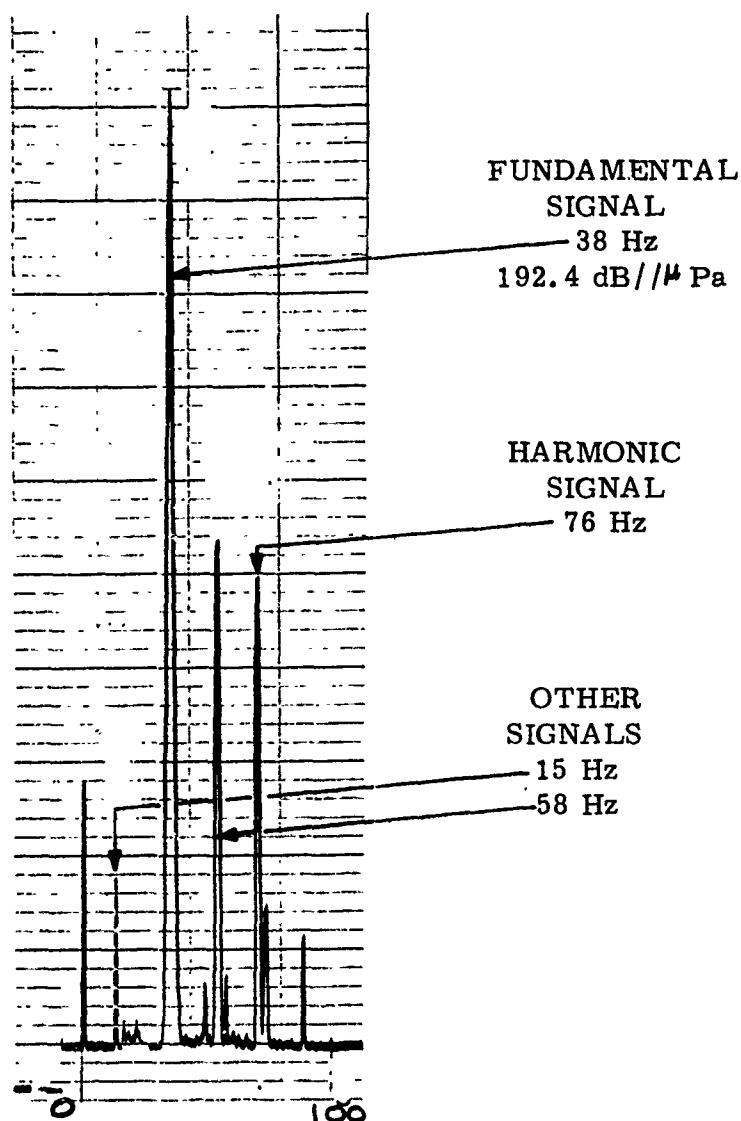


TIME
GMT 27 Sept 1973

FIGURE 130

CONFIDENTIAL

EVENT MS θ
INBOUND TOW
(DATA ANALYSIS PLAN EXPERIMENT NUMBER 33)
SAMPLE SIGNAL SPECTRUM RECORDING



FREQUENCY
270629Z SEPT 1973

SHALLOW SOURCE

FIGURE 131

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TABLE 60

EVENT MS 0

TIME/POSITION OF VESSEL

TIME GMT SEPT 1973	TYPE	LATITUDE ° N	LONGITUDE ° W
261135	DR	35° 59. 2'	134° 00. 1'
261208	F	35° 59. 0'	133° 58. 7'
261318	F	36° 00. 1'	133° 53. 6'
261354	F	36° 00. 8'	133° 51. 0'
261504	F	36° 02. 0'	133° 44. 6'
261730	F	36° 04. 3'	133° 32. 7'
261900	DR	36° 05. 1'	133° 24. 1'
261935	F	36° 05. 4'	133° 23. 3'
262100	F	36° 03. 8'	133° 11. 1'
262200	DR	36° 04. 0'	133° 09. 5'
262300	F	36° 06. 9'	133° 05. 1'
270006	DR	36° 08. 0'	132° 59. 9'
270134	DR	36° 08. 1'	132° 53. 6'
270200	F	36° 08. 6'	132° 51. 2'
270300	DR	36° 09. 1'	132° 46. 3'
270400	F	36° 10. 0'	132° 41. 3'
270500	DR	36° 10. 9'	132° 35. 3'
270547	DR	36° 09. 5'	132° 33. 3'
270600	DR	36° 09. 7'	132° 31. 6'
270700	F	36° 10. 6'	132° 27. 1'
290800	DR	36° 09. 6'	132° 29. 3'

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TIME/POSITION HISTORY OF M/V MED SEAL

FROM 281600Z AUG 1973

TO 272113Z SEPT 1973

	Latitude	Longitude	TIME GMT	DAY	MONTH	YEAR
MEDSEAL	38 045N	130 199W	1600	28	08	73
MEDSEAL	38 070N	130 356W	1726	28	08	73
MEDSEAL	38 070N	130 356W	1900	28	08	73
MEDSEAL	38 080N	130 370W	2300	28	08	73
MEDSEAL	38 135N	130 382W	0038	29	08	73
MEDSEAL	38 052N	130 362W	0528	29	08	73
MEDSEAL	38 089N	130 360W	1142	29	08	73
MEDSEAL	38 060N	130 401W	2042	29	08	73
MEDSEAL	38 043N	130 554W	2252	29	08	73
MEDSEAL	38 044N	130 586W	2323	29	08	73
MEDSEAL	38 040N	131 012W	0020	30	08	73
MEDSEAL	38 048N	131 264W	0554	30	08	73
MEDSEAL	38 050N	131 460W	1100	30	08	73
MEDSEAL	38 040N	131 462W	1230	30	08	73
MEDSEAL	38 035N	132 270W	1810	30	08	73
MEDSEAL	38 050N	132 530W	2200	30	08	73
MEDSEAL	38 062N	133 162W	0220	31	08	73
MEDSEAL	38 065N	133 207W	0355	31	08	73
MEDSEAL	38 055N	133 252W	0435	31	08	73
MEDSEAL	38 043N	133 345W	0605	31	08	73
MEDSEAL	38 044N	133 379W	0645	31	08	73
MEDSEAL	38 026N	133 596W	1025	31	08	73
MEDSEAL	38 010N	134 113W	1230	31	08	73
MEDSEAL	38 000N	134 198W	1403	31	08	73
MEDSEAL	38 010N	134 250W	1500	31	08	73
MEDSEAL	38 010N	134 280W	1526	31	08	73
MEDSEAL	38 009N	134 290W	1543	31	08	73
MEDSEAL	38 014N	134 369W	1700	31	08	73
MEDSEAL	38 034N	134 340W	1800	31	08	73
MEDSEAL	38 040N	134 440W	1900	31	08	73
MEDSEAL	38 040N	134 500W	2100	31	08	73
MEDSEAL	38 020N	134 438W	2330	31	08	73
MEDSEAL	37 590N	134 427W	0300	01	09	73
MEDSEAL	37 562N	134 591W	0426	01	09	73
MEDSEAL	37 506N	135 334W	0700	01	09	73
MEDSEAL	37 427N	136 245W	1047	01	09	73

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	37	398N	136	443W	1223	010973
MEDSEAL	37	302N	137	316W	1600	010973
MEDSEAL	37	272N	137	591W	1815	010973
MEDSEAL	37	238N	138	307W	2040	010973
MEDSEAL	37	167N	139	131W	0005	020973
MEDSEAL	37	110N	139	380W	0205	020973
MEDSEAL	37	007N	140	305W	0600	020973
MEDSEAL	36	580N	140	420W	700	020973
MEDSEAL	36	540N	141	065W	0850	020973
MEDSEAL	36	364N	142	370W	1605	020973
MEDSEAL	36	320N	142	490W	1628	020973
MEDSEAL	36	328N	142	472W	1900	020973
MEDSEAL	36	317N	142	480W	0330	030973
MEDSEAL	36	310N	142	495W	0340	030973
MEDSEAL	36	330N	142	480W	0456	030973
MEDSEAL	36	315N	142	480W	0942	030973
MEDSEAL	36	317N	142	484W	1330	030973
MEDSEAL	36	163N	143	170W	2026	030973
MEDSEAL	36	114N	143	250W	2215	030973
MEDSEAL	36	062N	143	363W	0003	040973
MEDSEAL	36	012N	143	445W	0215	040973
MEDSEAL	35	590N	143	499W	0315	040973
MEDSEAL	35	550N	143	560W	0415	040973
MEDSEAL	35	512N	144	047W	0615	040973
MEDSEAL	35	461N	144	182W	0830	040973
MEDSEAL	35	525N	144	167W	0930	040973
MEDSEAL	35	562N	144	176W	1023	040973
MEDSEAL	36	047N	144	190W	1218	040973
MEDSEAL	36	100N	144	210W	1335	040973
MEDSEAL	36	148N	144	216W	1515	040973
MEDSEAL	36	145N	144	218W	1729	040973
MEDSEAL	36	126N	144	055W	2127	040973
MEDSEAL	36	112N	143	550W	2316	040973
MEDSEAL	36	111N	143	541W	2331	040973
MEDSEAL	36	093N	143	405W	0152	050973
MEDSEAL	36	088N	143	311W	0340	050973
MEDSEAL	36	080N	143	146W	0715	050973
MEDSEAL	36	076N	142	580W	1025	050973
MEDSEAL	36	070N	142	494W	1200	050973
MEDSEAL	36	010N	142	394W	1836	050973
MEDSEAL	35	501N	142	467W	2040	050973
MEDSEAL	35	532N	142	561W	2321	050973
MEDSEAL	35	559N	142	597W	0109	060973
MEDSEAL	35	599N	143	055W	0212	060973
MEDSEAL	36	044N	143	179W	0412	060973
MEDSEAL	36	070N	143	210W	0557	060973
MEDSEAL	36	100N	143	390W	0850	060973
MEDSEAL	36	188N	143	440W	1120	060973
MEDSEAL	36	219N	143	494W	1230	060973
MEDSEAL	36	395N	144	110W	1611	060973

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TIME/POSITION - M/V MED SEAL
(Continued)

MEDSEAL	36 426N	143 587W	1822 060973
MEDSEAL	36 415N	144 001W	2140 060973
MEDSEAL	36 307N	143 502W	0148 070973
MEDSEAL	36 187N	143 400W	0450 070973
MEDSEAL	36 066N	143 309W	0722 070973
MEDSEAL	35 575N	143 277W	0948 070973
MEDSEAL	35 568N	143 253W	1013 070973
MEDSEAL	35 533N	143 214W	1130 070973
MEDSEAL	35 516N	143 195W	1202 070973
MEDSEAL	35 450N	143 160W	1330 070973
MEDSEAL	35 446N	143 154W	1347 070973
MEDSEAL	35 346N	143 154W	1655 070973
MEDSEAL	35 357N	143 409W	2105 070973
MEDSEAL	35 461N	143 446W	0506 080973
MEDSEAL	36 090N	143 315W	1030 080973
MEDSEAL	36 188N	143 252W	1230 080973
MEDSEAL	36 250N	143 182W	1439 080973
MEDSEAL	36 390N	143 100W	1807 080973
MEDSEAL	36 517N	143 097W	2300 080973
MEDSEAL	37 344N	143 223W	0253 090973
MEDSEAL	37 441N	143 252W	0400 090973
MEDSEAL	38 048N	143 329W	0600 090973
MEDSEAL	38 157N	143 366W	0703 090973
MEDSEAL	38 422N	143 437W	1200 090973
MEDSEAL	38 405N	143 450W	1343 090973
MEDSEAL	38 412N	143 446W	2254 090973
MEDSEAL	38 430N	143 437W	2309 090973
MEDSEAL	38 527N	143 400W	0103 100973
MEDSEAL	38 567N	143 379W	0200 100973
MEDSEAL	39 015N	143 355W	0310 100973
MEDSEAL	39 074N	143 321W	0406 100973
MEDSEAL	39 114N	143 313W	0502 100973
MEDSEAL	39 149N	143 282W	0601 100973
MEDSEAL	39 245N	143 225W	0920 100973
MEDSEAL	39 260N	143 214W	1042 100973
MEDSEAL	39 326N	143 179W	1227 100973
MEDSEAL	39 565N	143 091W	0124 110973
MEDSEAL	39 549N	143 233W	0250 110973
MEDSEAL	39 533N	143 353W	0340 110973
MEDSEAL	39 524N	143 487W	0438 110973
MEDSEAL	39 509N	143 518W	0500 110973
MEDSEAL	39 420N	143 428W	1200 110973
MEDSEAL	39 399N	143 417W	1230 110973
MEDSEAL	39 228N	143 326W	1743 110973
MEDSEAL	39 170N	143 307W	1851 110973
MEDSEAL	39 030N	143 255W	2203 110973
MEDSEAL	38 572N	143 201W	0010 120973
MEDSEAL	38 521N	143 164W	0110 120973
MEDSEAL	38 422N	143 118W	0328 120973
MEDSEAL	38 396N	143 105W	0410 120973

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	38	393N	143	12 W	0645	120973
MEDSEAL	38	548N	142	503W	1237	120973
MEDSEAL	39	068N	143	145W	1830	120973
MEDSEAL	39	088N	143	184W	1930	120973
MEDSEAL	39	126N	143	239W	2023	120973
MEDSEAL	39	146N	143	277W	2110	120973
MEDSEAL	39	190N	143	369W	2300	120973
MEDSEAL	39	234N	143	472W	0111	130973
MEDSEAL	39	291N	143	599W	0420	130973
MEDSEAL	39	309N	144	026W	0503	130973
MEDSEAL	39	326N	144	072W	0610	130973
MEDSEAL	39	340N	144	103W	0703	130973
MEDSEAL	39	465N	144	278W	1047	130973
MEDSEAL	39	576N	144	425W	1215	130973
MEDSEAL	40	103N	145	003W	1355	130973
MEDSEAL	40	191N	145	124W	1500	130973
MEDSEAL	40	434N	145	438W	1800	130973
MEDSEAL	40	510N	145	530W	1917	130973
MEDSEAL	41	160N	146	334W	2300	130973
MEDSEAL	41	143N	146	318W	2353	130973
MEDSEAL	41	132N	146	296W	0040	140973
MEDSEAL	41	252N	146	477W	0600	140973
MEDSEAL	41	250N	146	511W	0715	140973
MEDSEAL	41	269N	146	547W	1145	140973
MEDSEAL	41	268N	146	484W	1236	140973
MEDSEAL	41	270N	147	052W	1630	140973
MEDSEAL	41	279N	147	086W	1720	140973
MEDSEAL	41	270N	146	592W	1900	140973
MEDSEAL	41	205N	146	514W	2028	140973
MEDSEAL	41	155N	146	501W	2100	140973
MEDSEAL	40	595N	146	454W	2227	140973
MEDSEAL	40	423N	146	407W	0000	150973
MEDSEAL	40	403N	146	402W	0014	150973
MEDSEAL	40	288N	146	370W	0124	150973
MEDSEAL	40	183N	146	340W	0215	150973
MEDSEAL	40	105N	146	331W	0300	150973
MEDSEAL	40	002N	146	285W	0400	150973
MEDSEAL	39	595N	146	232W	0900	150973
MEDSEAL	40	006N	146	217W	1227	150973
MEDSEAL	40	010N	146	233W	1845	150973
MEDSEAL	39	595N	146	290W	2121	150973
MEDSEAL	39	583N	146	283W	2324	150973
MEDSEAL	39	591N	146	275W	2346	150973
MEDSEAL	40	000N	146	242W	0600	160973
MEDSEAL	39	547N	146	211W	0717	160973
MEDSEAL	39	475N	146	166W	0908	160973
MEDSEAL	39	377N	146	156W	1100	160973
MEDSEAL	39	243N	146	131W	1330	160973
MEDSEAL	39	170N	146	120W	1433	160973
MEDSEAL	39	156N	146	128W	1638	160973

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	39 139N	146 150W	2350	160973
MEDSEAL	39 068N	146 105W	0124	170973
MEDSEAL	39 019N	146 080W	0245	170973
MEDSEAL	38 567N	146 060W	0408	170973
MEDSEAL	38 521N	146 041W	0515	170973
MEDSEAL	38 480N	146 018W	0615	170973
MEDSEAL	38 459N	146 010W	0650	170973
MEDSEAL	38 357N	145 572W	0940	170973
MEDSEAL	38 328N	145 572W	1150	170973
MEDSEAL	38 314N	145 570W	1800	170973
MEDSEAL	38 338N	145 101W	2144	170973
MEDSEAL	38 342N	144 547W	2320	170973
MEDSEAL	38 287N	144 431W	0050	180973
MEDSEAL	38 314N	144 080W	0500	180973
MEDSEAL	38 311N	143 592W	0610	180973
MEDSEAL	38 326N	143 398W	0745	180973
MEDSEAL	38 338N	143 291W	0900	180973
MEDSEAL	38 310N	143 304W	1030	180973
MEDSEAL	38 460N	143 280W	2038	180973
MEDSEAL	38 483N	143 355W	2200	180973
MEDSEAL	38 478N	143 310W	2230	180973
MEDSEAL	38 507N	143 351W	0043	190973
MEDSEAL	38 536N	143 245W	0417	190973
MEDSEAL	38 573N	143 577W	0700	190973
MEDSEAL	39 030N	144 065W	1030	190973
MEDSEAL	39 115N	144 180W	1525	190973
MEDSEAL	39 133N	144 215W	1625	190973
MEDSEAL	39 153N	144 244W	1745	190973
MEDSEAL	39 203N	144 294W	1954	190973
MEDSEAL	39 243N	144 328W	2140	190973
MEDSEAL	39 286N	144 360W	2357	190973
MEDSEAL	39 394N	144 174W	0236	200973
MEDSEAL	39 436N	144 019W	0350	200973
MEDSEAL	39 490N	143 415W	0540	200973
MEDSEAL	39 501N	143 244W	1127	200973
MEDSEAL	39 506N	143 321W	1217	200973
MEDSEAL	39 392N	143 287W	1728	200973
MEDSEAL	39 352N	143 282W	1826	200973
MEDSEAL	39 259N	143 276W	2212	200973
MEDSEAL	39 242N	143 300W	2305	200973
MEDSEAL	39 192N	143 297W	0020	210973
MEDSEAL	39 137N	143 282W	0150	210973
MEDSEAL	39 057N	143 291W	0411	210973
MEDSEAL	38 597N	143 324W	0600	210973
MEDSEAL	38 526N	143 342W	0740	210973
MEDSEAL	38 424N	143 300W	1015	210973
MEDSEAL	38 375N	143 289W	1200	210973
MEDSEAL	38 253N	143 298W	1450	210973
MEDSEAL	38 253N	143 298W	1450	210973

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	38 196N	143 176w	1610	210973
MEDSEAL	38 124N	142 597w	1800	210973
MEDSEAL	38 051N	142 435w	1900	210973
MEDSEAL	37 545N	142 111W	2207	210973
MEDSEAL	37 525N	142 050w	2240	210973
MEDSEAL	37 457N	141 415w	0055	220973
MEDSEAL	37 430N	141 309w	0152	220973
MEDSEAL	37 380N	141 209w	0250	220973
MEDSEAL	37 330N	141 085w	0355	220973
MEDSEAL	37 304N	141 007w	0622	220973
MEDSEAL	37 299N	141 014w	0730	220973
MEDSEAL	37 303N	141 000w	0820	220973
MEDSEAL	37 298N	140 570w	1115	220973
MEDSEAL	37 316N	140 592w	1255	220973
MEDSEAL	37 315N	140 564w	1556	220973
MEDSEAL	37 278N	140 495w	1752	220973
MEDSEAL	37 250N	140 415w	2005	220973
MEDSEAL	37 231N	140 308w	2220	220973
MEDSEAL	37 218N	140 222w	0005	230973
MEDSEAL	37 206N	140 170w	0120	230973
MEDSEAL	37 198N	140 133w	0207	230973
MEDSEAL	37 188N	140 081w	0305	230973
MEDSEAL	37 177N	139 591w	0500	230973
MEDSEAL	37 164N	139 539w	0600	230973
MEDSEAL	37 158N	139 477w	0720	230973
MEDSEAL	37 153N	139 430w	0800	230973
MEDSEAL	37 132N	139 324w	1000	230973
MEDSEAL	37 102N	139 210w	1215	230973
MEDSEAL	37 046N	138 596w	1415	230973
MEDSEAL	36 565N	138 369w	2018	230973
MEDSEAL	36 554N	138 368w	2054	230973
MEDSEAL	36 550N	138 342w	2130	230973
MEDSEAL	37 010N	138 290w	2340	230973
MEDSEAL	36 591N	138 245w	0100	240973
MEDSEAL	36 584N	138 196w	0203	240973
MEDSEAL	36 567N	138 141w	0300	240973
MEDSEAL	36 565N	138 086w	0400	240973
MEDSEAL	36 560N	138 035w	0500	240973
MEDSEAL	36 550N	137 586w	0600	240973
MEDSEAL	36 539N	137 526w	0700	240973
MEDSEAL	36 528N	137 472w	0810	240973
MEDSEAL	36 492N	137 365w	1000	240973
MEDSEAL	36 480N	137 332w	1042	240973
MEDSEAL	36 474N	137 315w	1100	240973
MEDSEAL	36 455N	137 204w	1310	240973
MEDSEAL	36 443N	137 166w	1410	240973
MEDSEAL	36 434N	137 149w	1521	240973
MEDSEAL	36 412N	137 136w	1620	240973
MEDSEAL	36 435N	137 125w	1738	240973

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	36 445N	137 065W	1900	240973
MEDSEAL	36 420N	137 027W	2032	240973
MEDSEAL	36 410N	136 592W	2116	240973
MEDSEAL	36 407N	136 569W	2145	240973
MEDSEAL	36 408N	136 509W	2317	240973
MEDSEAL	36 389N	136 434W	0050	250973
MEDSEAL	36 374N	136 383W	0520	250973
MEDSEAL	36 367N	136 310W	0400	250973
MEDSEAL	36 315N	136 142W	0545	250973
MEDSEAL	36 312N	136 056W	0833	250973
MEDSEAL	36 315N	135 589W	1000	250973
MEDSEAL	36 282N	135 546W	1200	250973
MEDSEAL	36 267N	135 474W	1305	250973
MEDSEAL	36 237N	135 351W	1509	250973
MEDSEAL	36 224N	135 290W	1600	250973
MEDSEAL	36 200N	135 228W	1700	250973
MEDSEAL	36 182N	135 160W	1800	250973
MEDSEAL	36 160N	135 103W	1900	250973
MEDSEAL	36 156N	135 073W	1930	250973
MEDSEAL	36 265N	134 484W	2220	250973
MEDSEAL	36 263N	134 424W	2305	250973
MEDSEAL	36 136N	134 437W	0015	260973
MEDSEAL	36 105N	134 409W	0100	260973
MEDSEAL	36 098N	134 357W	0210	260973
MEDSEAL	36 082N	134 345W	0300	260973
MEDSEAL	36 064N	134 296W	0415	260973
MEDSEAL	36 058N	134 264W	0500	260973
MEDSEAL	36 050N	134 217W	0555	260973
MEDSEAL	36 035N	134 192W	0700	260973
MEDSEAL	36 027N	134 146W	0800	260973
MEDSEAL	36 017N	134 113W	0900	260973
MEDSEAL	36 008N	134 072W	1000	260973
MEDSEAL	35 598N	134 032W	1100	260973
MEDSEAL	35 591N	134 000W	1135	260973
MEDSEAL	36 009N	133 502W	1400	260973
MEDSEAL	36 021N	133 452W	1500	260973
MEDSEAL	36 031N	133 395W	1600	260973
MEDSEAL	36 039N	133 339W	1700	260973
MEDSEAL	36 047N	133 297W	1800	260973
MEDSEAL	36 051N	133 241W	1900	260973
MEDSEAL	36 055N	133 200W	2000	260973
MEDSEAL	36 056N	133 150W	2055	260973
MEDSEAL	36 040N	133 097W	2200	260973
MEDSEAL	36 062N	133 100W	2222	260973

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TIME/POSITION - M/V MED SEAL (Continued)

MEDSEAL	36 069N	133 051W	2300	260973
MEDSEAL	36 080N	132 598W	0000	270973
MEDSEAL	36 082N	132 540W	0100	270973
MEDSEAL	36 086N	132 510W	0200	270973
MEDSEAL	36 091N	132 465W	0300	270973
MEDSEAL	36 100N	132 415W	0400	270973
MEDSEAL	36 110N	132 352W	0500	270973
MEDSEAL	36 095N	132 315W	0640	270973
MEDSEAL	36 110N	132 300W	1010	270973
MEDSEAL	36 131N	132 165W	1210	270973
MEDSEAL	36 150N	132 000W	1400	270973
MEDSEAL	36 158N	131 534W	1500	270973
MEDSEAL	36 163N	131 336W	1730	270973
MEDSEAL	36 194N	131 231W	1900	270973
MEDSEAL	36 208N	131 127W	2113	270973

The TIME/POSITION data presented above was compiled by NAVOCEANO.

APPENDIX B
TYPE F36 TRANSDUCER
TECHNICAL DATA

UNCLASSIFIED**USRD TYPE F36 TRANSDUCER****1. GENERAL DESCRIPTION**

The USRD type F36 transducer is designed to provide smooth response in the frequency range 10 Hz to 20 kHz when used as a hydrophone. It is useful also as a sound source in the range 1 to 20 kHz.

The sensitive element consists of 7 lead zirconate - lead titanate capped cylinders mounted one above the other to form a line 8 inches long. The elements are housed within an oil-filled butyl rubber boot over a framework of 6 steel rods that provide protection and support without affecting the acoustic characteristics. The transducer is supplied with 100 feet of 2-conductor shielded neoprene-sheathed cable.

2. SPECIFICATIONS

Frequency range: 10 Hz to 20 kHz, as hydrophone

Free-field voltage sensitivity: -101 dB re 1 V/ μ bar at end of 100-ft cable

Transmitting voltage response: 24 dB re 1 μ bar/V at 10 kHz

Maximum voltage: 150 V (rms)

Nominal capacitance: 60 000 pF (with 100-ft cable)

D-c resistance: greater than 2000 megohms

Maximum hydrostatic pressure: 400 psig

Operating temperature range: 0 to 35°C

Acoustic center: physical center of rubber boot (5 inches from either end)

3. FREQUENCY - SENSITIVITY CHARACTERISTICS

Figure 1 is a typical free-field voltage sensitivity curve for the type F36 transducer, measured in terms of open-circuit voltage at the end of 100 feet of cable. The sensitivity of each transducer is provided by the calibration curve furnished with it. Sensitivity depends on the frequency characteristics of the amplifier used and on the resistance and capacitance of the input circuit (including transducer, cable, and amplifier input impedance). The capacitance of the transducer with 100 feet of cable is greater than 60 000 pF. The input impedance of the amplifier should be at least 3 M Ω to insure that its effect on the response of the transducer at low frequencies is negligible.

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Additional cable can be used with the transducer; however, the added cable will increase the shunt capacitance, and the over-all sensitivity will be correspondingly lower.

The transmitting voltage response from 1 to 25 kHz is shown in Fig. 2. It is recommended that the transducer not be used above 20 kHz.

4. TEMPERATURE - SENSITIVITY CHARACTERISTICS

The sensitivity of the type F36 transducer does not vary significantly with temperature in the range 5 to 30°C.

5. HYDROSTATIC PRESSURE - SENSITIVITY CHARACTERISTICS

No changes have been observed in the sensitivity of the transducer with hydrostatic pressure up to 400 psig.

6. DIRECTIVITY

The transducer is omnidirectional within ± 0.5 dB in the plane (XY) normal to its longitudinal axis. The vertical (XZ plane) directivity is equivalent to that of an 8-inch line. Typical vertical directivity patterns are shown in Fig. 3.

7. PREPARATION OF THE TRANSDUCER FOR USE

Attach a fixture to the molded cable gland as near as possible to the transducer. When no fixture is used, a line should be attached to the lifting eyes to remove the tension from the cable and the gland. A pad eye is provided at the lower end of the transducer also, so that a weight can be attached if necessary. The weight should not be greater than 25 pounds. Wash the entire transducer with a wetting agent such as Aerosol. Air bubbles must be removed as completely as possible when the transducer is lowered into the water, to avoid erroneous results.

8. CAUTIONS

This transducer is a calibrated standard and should be handled with care. Avoid sharp blows and punctures to the rubber boot and the cable sheath. Store in the carrying case when not in use.

9. MAINTENANCE AND CALIBRATION

As a reference standard, the transducer should be recalibrated by NRL, USRD at intervals not greater than one year. For all repairs and calibration, return the transducer to the Naval Research Laboratory, Underwater Sound Reference Division, 4501 S. Summerlin Ave., Orlando, Florida 32806.

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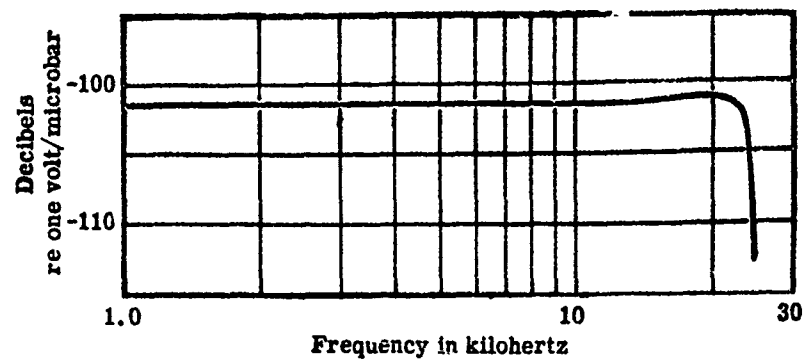


Fig. 1. Typical free-field voltage sensitivity, USRD type F36 transducer (open-circuit voltage at end of 100-ft cable).

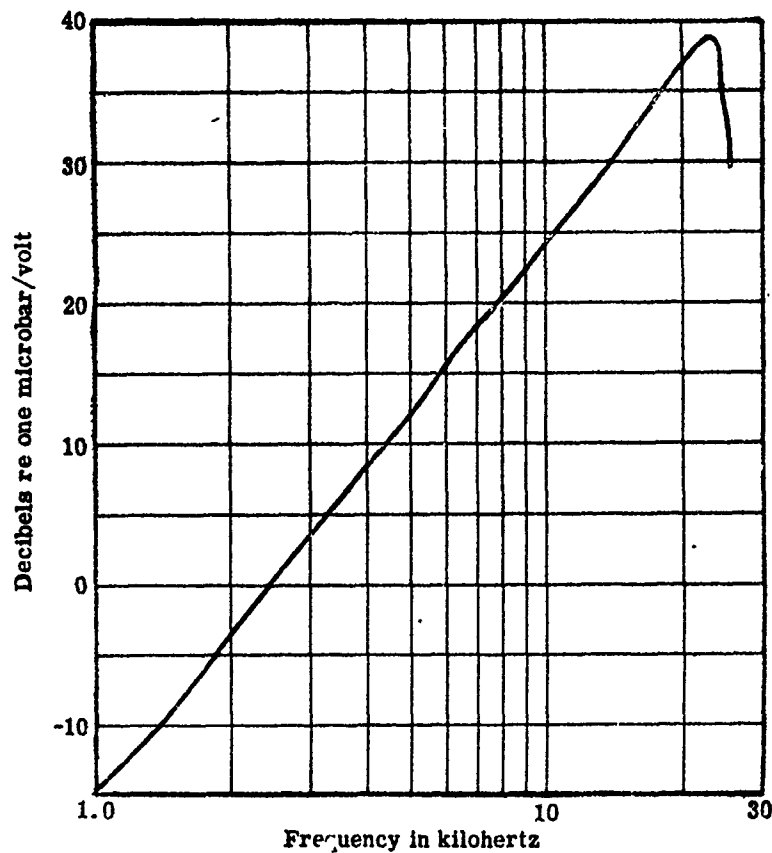
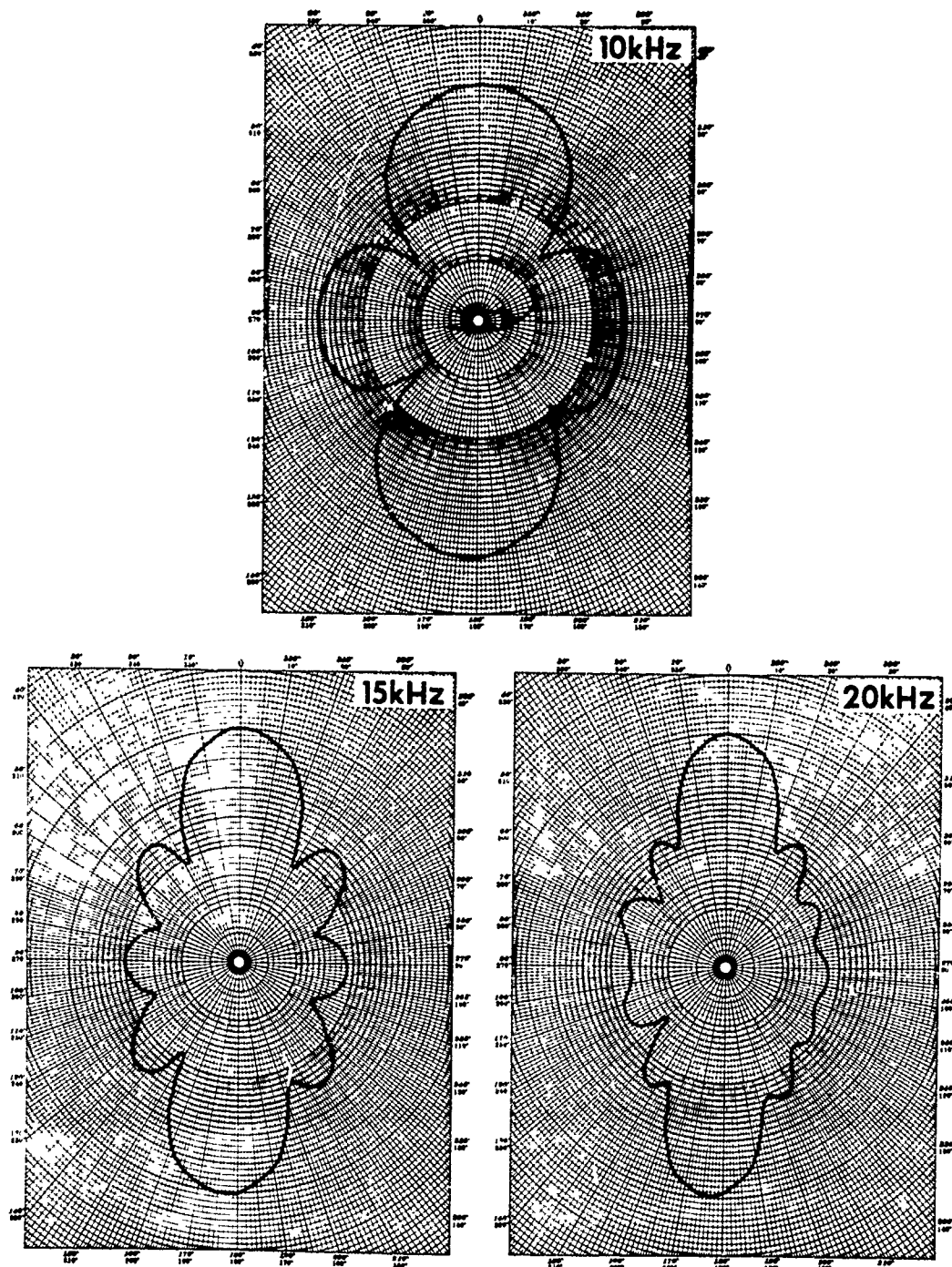


Fig. 2. Typical transmitting voltage response, USRD type F36 transducer.

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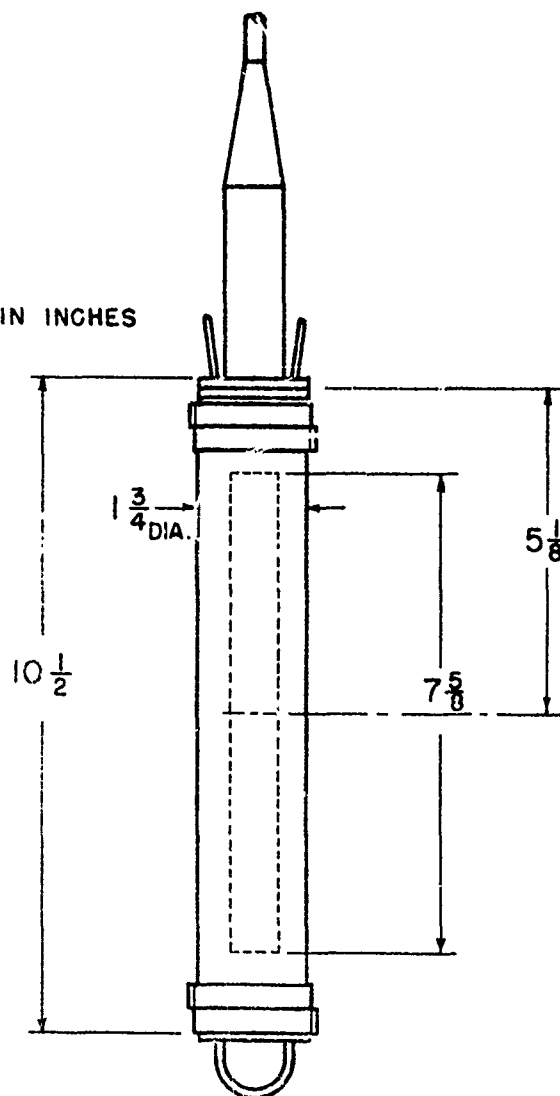
Scale: Center to top of grid, each pattern, equals 50 dB

Fig. 3. Typical directivity patterns in the XZ plane, USRD type F36 transducer.

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ALL DIMENSIONS IN INCHES



ACTIVE ELEMENT

(7) - PZT-5 CAPPED TUBES

.750 x .750 x .062 WALL THICKNESS

USRD

F 36

TRANSDUCER

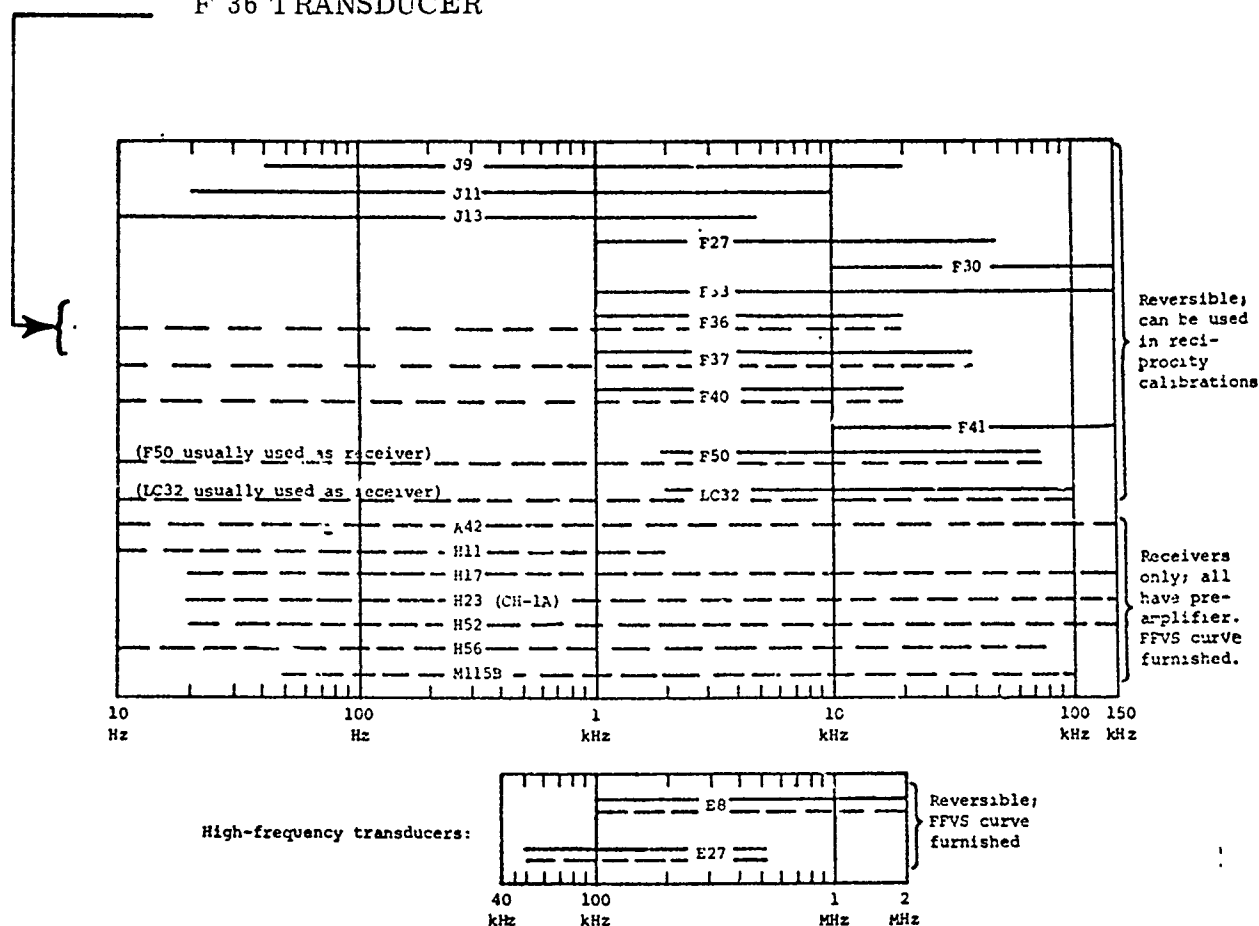
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TRANSDUCER FREQUENCY RANGE

F 36 TRANSDUCER



Frequency ranges of transducers available from USRD-NRL. Solid line shows frequency range as source; dashed line, frequency range as receiver.

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TRANSDUCER CHARACTERISTICS

Type	Status code(1)	Developed by/ Manufactured by	Electroacoustic element & size	Preamp. coupling(2)	Freq. range (kHz)	Sensitivity at end of cable (dB re 1 V/uPa)	Max. depth (m)	Source level(3) (dB re 1 uPa)	Cable type & length	Weight with cable (kg)	Ship. weight (kg)	Type
A42	A	USRD/USRD	lead zirconate titanate 0.32 cm diam x 0.32 cm long	transistor 0 dB	0.01-200	-216 (50 kHz)	690	NA	2-c. sh. 9 m	0.4	6	A42
CH-1A	B,C(4)	USRL-Clevite Corp./Clevite Corp.	lithium sulfate line 0.32x0.48x5.08 cm	transistor +6 dB	0.02-150	-188 (1 kHz)	1720	NA	5-c. sh. 23 m	6	13	CH-1A
E1	A	USRL/USRL	lithium sulfate 1.91-cm-diam piston	NA (transformer)	100-2000	-208 (200 kHz)	30	175 (200 kHz)	RG-62/U 2-7 m	2	7	E8
E27	A	USRL/USRL	lead zirconate titanate; 7 disks 0.32 cm diam forming 1.11-cm-diam piston	NA	50-500	-213 (100 kHz)	30	155 (100 kHz)	RG-62/U 9 m	0.7	4.5	E27
F27	A(4)	USRL/USRL	lead metaniobate, 22.9-cm-diam piston	NA	1-50	-197 (1 kHz)	3450	165 (10 kHz)	2-c. sh. 30 m	15	23	F27
F30	A(4)	USRL/USRL	lithium sulfate, 3.81x5.08-cm piston	NA (transformer)	10-150	-217 (50 kHz)	2410	165 (50 kHz)	2-c. sh. 12 m	3	8	F30
F33	A	USRL/Fitzgerald Laboratories	entire array: modified BT 22.9-cm-diam piston; inner array: lead zirconate titanate, 3.81x5.08-cm piston	NA NA	1-50 10-150	-204 (1 kHz) -206 (50 kHz)	340	169 (10 kHz) 172 (50 kHz)	4-c. sh. 30 m	17	25	F33
F36	A(4)	USRL/USRL	lead zirconate titanate line 1.91 cm diam x 19.3 cm long	NA	1-23	-202 (10 kHz)	270	177 (20 kHz)	2-c. sh. 30 m	4	6	F36
F37	A,C(4)	USRL/Edo West. Corp.	lead zirconate titanate line 1.27 cm diam x 16.4 cm long	NA	1-37	-204 (10 kHz)	270	175 (20 kHz)	2-c. sh. 30 m	4	6	F37
F40	B	USRD/USRD	lead zirconate titanate hollow sphere 10.16 cm diam with 6.35 mm wall	NA	1-20	-187 (1 kHz)	690	192 (10 kHz)	2-c. sh. 1 m	4	9	F40
F41	A	USRL/Dyna-Empire, Inc.	lead zirconate titanate 3.81x5.08-cm piston	NA	10-150	-206 (50 kHz)	340	172 (50 kHz)	2-c. sh. 30 m	4	9	F41

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APPENDIX C

REFERENCES

1. Arthur D. Little, Inc., "Summary Vibroseis Acceptance and Calibration, Preliminary Report," Contract No. N00014-72-C-0173, Cambridge, Mass., 14 September 1973, (U).
2. MAURY CENTER FOR OCEAN SCIENCE, 1973, "CHURCH ANCHOR Exercise Plan": Washington, Maury Center Plan MC-011 (CONFIDENTIAL CAN/US ONLY, Unclassified Title); Supplements A and B (SECRET).
3. MAURY CENTER FOR OCEAN SCIENCE, OCTOBER 1973, "CHURCH ANCHOR Data Analysis Plan": Washington, Maury Center Plan NC-001, Volume 1 (SECRET), Volume 2 (CONFIDENTIAL), Supplement A to Volume 2 (SECRET).

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APPENDIX X
DISTRIBUTION LIST

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Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
Unavailable	Brancart, C. P.	TRANSMISSION REPORT, VIBROSEIS CW ACOUSTIC SOURCE, CHURCH ANCHOR EXERCISE, AUGUST AND SEPTEMBER 1973	B-K Dynamics, Inc.	730101	AD0528904	U
Unavailable	Daubin, S. C., et al.	LONG RANGE ACOUSTIC PROPAGATION PROJECT. BLAKE TEST SYNOPSIS REPORT	University of Miami, Rosenstiel School of Marine and Atmospheric Science	730101	AD0768995	U
NUSC TR NO. 4457	King, P. C., et al.	MOORED ACOUSTIC BUOY SYSTEM (MABS): SPECIFICATIONS AND DEPLOYMENTS	Naval Underwater Systems Center	730105	AD0756181; ND	U
MC-012	Unavailable	CHURCH GABBRO SYNOPSIS REPORT (U)	Maury Center for Ocean Science	730210	ND	U
Unavailable	Hecht, R. J., et al.	STATISTICAL ANALYSIS OF OCEAN NOISE	Underwater Systems, Inc.	730220	AD0526024	U
Raff rept 73-2	Bowen, J. I., et al.	EASTLANT SHIPPING DENSITIES	Raff Associates, Inc.	730227	ND AD07627	U
Unavailable	Sander, E. L.	SHIPPING SURVEILLANCE DATA FOR CHURCH GABBRO	Raff Associates, Inc.	730315	AD0765360	U
Unavailable	Wagstaff, R. A.	RANDI: RESEARCH AMBIENT NOISE DIRECTIONALITY MODEL	Naval Undersea Center	730401	AD0760692	U
Unavailable	Van Wyckhouse, R. J.	SYNTHETIC BATHYMETRIC PROFILING SYSTEM (SYNBAPS)	Naval Oceanographic Office	730501	AD0762070	U
MCPLAN012	Unavailable	SQUARE DEAL EXERCISE PLAN (U)	Maury Center for Ocean Science	730501	NS; ND	U
Unavailable	Marshall, S. W.	AMBIENT NOISE AND SIGNAL-TO-NOISE PROFILES IN IOMEDEX	Naval Research Laboratory	730601	AD0527037	U
Unavailable	Daubin, S. C.	CHURCH GABBRO TECHNICAL NOTE: SYSTEMS DESCRIPTION AND PERFORMANCE	University of Miami, Rosenstiel School of Marine and Atmospheric Science	730601	AD0763460	U
MC-011	Unavailable	CHURCH ANCHOR EXERCISE PLAN (U)	Maury Center for Ocean Science	730601	ND	U
Unavailable	Solosko, R. B.	SEMI-AUTOMATIC SYSTEM FOR DIGITIZING BATHYMETRY CHARTS	Calspan Corp.	730613	AD0761647	U
64	Jones, C. H.	LRAPP VERTICAL ARRAY- PHASE II	Westinghouse Research Laboratories	730613	AD0786239; ND	U
Unavailable	Kornigs, P. D., et al.	ANALYSIS OF PROPAGATION LOSS AND SIGNAL-TO-NOISE RATIOS FROM IOMEDEX	Naval Underwater Systems Center	730615	AD0526552	U
NUSC TR 4417	Perrone, A. J.	INFRASONIC AND LOW-FREQUENCY AMBIENT-NOISE MEASUREMENTS OFF NEWFOUNDLAND	Naval Underwater Systems Center	730619	AD ND 913668	U
USRD Cal. Report No. 3576	Unavailable	CALIBRATION OF FLIP-CHURCH ANCHOR TRANSDUCERS SERIALS 15 AND 19	Naval Research Laboratory	730716	ND	U